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Battelle Technical Review

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Stretching the Scale of Temperature Measurement

VIGNETTE

JOEL W. CHASTAIN, JR.

Less than five years ago, science and industry regarded atomic energy as the obvious answer to a host of problems, technological and economic. More recently, according to Battelle's Joel W. Chastian, Jr., scientists and industrialists have come to see the field in perspective. "No longer viewed as a magical cure-all", he points out, "nuclear science is seen, rather, as a tool that will become increasingly important as our understanding of its grows. Those in a hurry have left the field. Those still interested, with maturity gained by experience, are patiently and ever more expertly utilizing their growing knowledge to benefit from the gradual, healthy growth that has now begun."

Since his participation in the establishment of Battelle's research reactor and critical assembly laboratory, Chaz has contributed to the excellence of much of the research done in the Institute's nuclear center. As these facilities were among the first in private operation, he and his colleagues have had to work out many basic operational problems. Today, their reactor research activities range from special studies, such as a current one on shielding for aircraft, to participation in the planning and design of experiments concerned with the radiation of materials. In the critical assembly laboratory, design data have been provided for a number of reactor systems including the boiling water, the beryllium-moderated sodium-cooled, and the gas-cooled package reactors.

As chief of the Institute's reactor physics division, Chaz also has a major concern with nuclear research involving theoretical calculations. Among such studies have been the physics and engineering analysis of the Fermi II Fast Breeder Reactor, the nuclear hazards problems associated with the first Army Package Power Reactor, and the operation of high-temperature gas-cooled systems.

Chaz wrote *U. S. Research Reactor Operation and Use*, one of the volumes presented to all delegates to last year's Geneva Conference on peacetime uses of atomic energy. His name also appears as author on more than two-score articles and reports based upon his researches. He serves currently as a member of the Reactor Subcommittee of the National Academy of Science—National Research Council and is active in the American Institute of Physics and the American Nuclear Society.

Prior to his association with Battelle, Chaz worked with the Case Institute of Technology's 30 MEV Betatron. During the same period he received his M.S. degree in physics from Case.

At home, the activities of their two small daughters and son have a most absorbing interest for both Chaz and his wife, Lida. Do-it-yourself activities in house and garden also help to keep both of them busy. They relax with music—Lida preferring classical, while Chaz goes for jazz, from hot to cool.

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NOTES from BATTELLE

* WOOD STABILIZATION

Recently initiated research is aimed at discovering a practical way of making wood less subject to shrinkage and swelling due to changes in humidity.

Scientists at Battelle hope to come up with a method for treating wood that will assure dimensional stability without adding appreciably to its weight. The treatment for which they are searching must be relatively inexpensive, so that wood can maintain its competitive position among building materials. A further condition is that the treatment not affect adversely any of the principal properties of wood, such as strength, ease of working, and acceptance of paint and other coatings.

"The idea of improving the stability of wood is not a new one", according to Dr. Robert I. Leininger, who is directing the research program. "But, thus far, no really generally applicable means has been found for increasing stability." The Battelle chemist acknowledged attempts made over the past fifty years to make wood less subject to shrinkage and swelling by such treatemnts as impregnating the micro-voids or tiny air pockets in wood with wax or plastics. "This work has resulted in some fairly stable specialty wood products, but their character and cost are such that they do not represent practical solutions to the problem."

Among the companies supporting the present research program are: Andersen Corporation of Bayport, Minnesota; Curtis Companies Incorporated, Clinton, Iowa; Morgan Company of Oshkosh, Wisconsin; and Potlatch Forests, Inc. of Lewiston, Idaho.

Initially, Battelle chemists and specialists in plastics, textile, and wood technology are screeing ideas for a suitable treatment. "We are not ruling out any possilibities at this time", Leininger said. "We are thinking of treatments for green lumber, dried lumber, and shaped wood pieces."

One approach that is being given serious consideration is the use of chemicals that will cause so-called "cross-linking" reactions within the wood fiber. Cross linking can be likened to putting braces or cross members between the beams of a house. By chemical reaction, molecular "braces" can be built between the long parallel chains of molecules that are the basic structure of wood and many other materials. These cross links tend to discourage shrinkage or swelling. Much work has been done by textile research specialists on cross-linking treatments for cotton fabrics to produce "wash-and-wear" qualities in cotton textiles, and this research may be of value in the present effort to stabilize wood.

Some thought, Dr. Leininger said, is also being given to certain gelatinous materials to fill the micro-voids in wood. Essentially, this approach would be aimed at maintaining the wood continuously in a partially or completely swollen state.

"These are only two of a number of approaches being considered", Dr. Leininger observed. "We will consider all ideas generated by our staff and any other ideas that may be brought to our attention by scientists in the chemical and wood industries." He cautioned, however, that "we may learn from our research that there is no single stability treatment that will be practical throughout the wood industry. But within the year's program, we expect to conduct a search for improved stability, broader and more intense than has ever before been undertaken."

* LEAD-CEMENTED ALLOYS

A promising exploratory study has shown the possibility of forming a new class of lead-base alloys called "lead-cemented alloys". These alloys are created by directly mixing molten lead and additions of finely-divided insoluble metal powders. The concept grew out of two unusual characteristics of lead—it has both a low melting temperature (621 F) and a low solubility for most other metals.

According to a report by Battelle metallurgists D. N. Williams, J. A. Houck, and R. I. Jaffee, the powdered additive metals must have two important properties of good wettability and of not dissolving in the molten lead to any appreciable extent. During the study, cobalt, copper, iron, molybdenum, nickel, and tungsten metal powders were successfully introduced into lead in amounts varying from 15 to 50 volume per cent.

The research, conducted in conjunction with the Lead Industries Association, afforded a number of interesting observations about the lead-cemented alloys. In most cases, the tensile strength of the alloys considerably exceeded that of the unalloyed lead, particularly at elevated temperature. The strength-temperature capabilities of lead could be increased about 300 F by the additions. It was found that an optimum composition appears to exist for each powder—thus 18 volume per cent was superior to 30 volume per cent of cobalt and 30 volume per cent was superior to 15 volume per cent of nickel. The metallurgists also found that alloy properties were improved by using finer powders with more spherical shape.

The completed study has shown the feasibility and some of the advantages of producing lead-cemented alloys. The metallurgists believe that the next step is to develop alloys for specific uses. Possibilities include uses in the chemical industry where corrosion resistance and higher temperatures are called for in bearing metal applications, and others. It is also possible that special uses may be developed that are uniquely suited for the alloys.

* GAS-POWERED AIR CONDITIONER

Some years ago, the American Gas Association posed this problem: "How can the potential heat energy in natural gas be transformed into a refrigerating effect with high efficiency and low first equipment cost in such a way as to be attractive for residential air-conditioning service?" Battelle technologists recommended several approaches; the one they finally developed was a combination of spark-ignition gas engine and vapor-compression refrigeration cycle. It was felt that such a combination would be compatible with existing air-conditioning systems employing commercial refrigerants and that it could be installed as a remote unit for new and remote replacement systems.

At a recent meeting of the American Society of Heating, Refrigerating, and Air Conditioning Engineers J. H. McNinch, R. W. King, and R. J. McCrory described the system as it was evolved at Battelle. The free-piston engine compressor was selected because it combines power-generation and vapor-compression functions in a single, simple unit. This simplicity, moreover, assures quieter operation and enhances the unit's dependability.

Cost estimates indicate that a three-ton, free-piston compressor (with desirable improvements) produced at an annual rate of 15,000 units, could probably be manufactured at costs comparable to those of other air-conditioning units.

* Recent appointments of Battelle staff members to key technical posts include: H. R. BATCHELDER—chairman, High Pressure—High Temperature Symposium (Atlanta, February, 1960), American Institute of Chemical Engineers; H. W. LOWNIE, JR.—member, Committee D-5 on Coal and Coke, American Society for Testing Materials, and member, Melting and Casting Committee, Institute of Metals, American Institute of Mining, Metallurgical, and Petroleum Engineers; DAUN PETERSEIM—chairman, Chemical Section, 30th All-Ohio Safety Congress; A. A. PUTMAN—member, Power Test Code Committee No. 3 on Fuels, American Society of Chemical Engineers; D. A. VAUGHAN—chairman, Group Committee T-3 (General Corrosion), National Association of Corrosion Engineers.

* A new conference-lecture type auditorium will be built by Battelle as a center for scientific, educational, and cultural activities, Dr. B. D. Thomas, Battelle president, has announced. It is anticipated that the $600,000 auditorium, with a seating capacity of 600, will be utilized, among other things, for meetings of regional and national scientific and technical societies and groups.

* Robert L. Carlson was a recipient of the Charles B. Dudley Medal of the American Society for Testing Materials at the Society's annual meeting last month. The Medal is given for the technical paper judged to be "of outstanding merit constituting an original contribution on research on engineeering materials." The award-winning paper, of which the Battelle technologist is a co-author, describes how temperature and other factors influence the strength and workability of low-carbon sheet steel.

Co-authors of the paper and co-recipients of the Dudley Medal are R. J. MacDonald of Clevite Research Center and W. T. Lankford of the United States Steel Corporation.

Stretching the Scale of Temperature

Formal methods for the measurement of temperature reach back the techniques of measurement have been advancing rapidly to keep pace with

by HERBERT W. DEEM

TEMPERATURE HAS BEEN A MATTER of concern to man throughout the ages. Early man recognized temperature differences as his feet burned on the hot rock in the sun or were chilled by the cold spring water. He first determined temperature as being either hot or cold by using himself as the reference point. Anything feeling colder than his skin was cold and anything above body temperature was hot.

With time man began to realize that his feelings were not an infallible reference point from which to judge hot or cold. The fevered man might feel cold while a well person might feel too warm in the same room. The cold weather fisherman putting his wind-swept hand into the lake might say that the water was warm while his friend with a warm dry hand might find the lake water cold. Man began to realize that he should have some means of measuring temperature that was devoid of human error. Though he long felt this need, man launched a program of temperature measurement less than 400 years ago.

The earliest-known-temperature-measuring device was invented by Galileo. About 1591, he devised an inverted air-filled bulb with a tube extending down into a liquid. As the air in the bulb contracted with lowered temperature, the liquid rose in the tube to a position marked "the cold of winter". As the air in the bulb warmed in summer, the liquid level in the tube lowered to a point "the heat of summer". Rey, in 1631, inverted the device and filled the bulb with a liquid but probably left the tube end open. Expansion and contraction of the liquid, as its temperature changed, raised or lowered the liquid level in the tube. The Florentine School is credited with being the first to seal the end of the glass tube. Alcohol was the liquid used in this thermometer. Boullian, in about 1655, introduced the mercury thermometer we know today. Such inventions as these started man in his race to measure higher and lower temperatures as he encountered them.

In general, it has been a case of necessity being the mother of invention in that the need to measure a temprature has generally preceded man's ability to make the measurement. While he continues to use body temperature as the dividing point between cold and hot, stretching the scale of temperature measurement has led to excursions both far below and high above body temperature.

When man began to understand that "cold" as such doesn't exist, but it really the absence of heat to a greater or lesser degree, the limit of low temperature was fixed—the point at which there is no heat. This point, then, marked the end of low-temperature attempts and has been shown to be —459.4 F.

MEASURING LOW TEMPERATURES

Scientists soon learned that the measurement of low temperatures presented difficult problems. The use of liquid-filled thermometers, for example, is limited to the temperatures at which the liquid freezes. Thus, mercury freezes at —38 F, ethyl alcohol at —179.1 F and ether at —190 F. There are other liquids such as the liquid gases which have much lower freezing points, but they also have very high vapor pressures at ordinary temperatures so are not useful in thermometers.

Seebeck discovered in 1821 that an electric current flows in a closed circuit of two dissimilar metals when the junctions of the metals are maintained at different temperatures. This is the thermocouple. If one of the junctions is maintained at a known constant temperature then the voltage generated by the other junction is a measure of its temperature. The voltage can be translated into degrees of temperature. Thermo-

Measurement

about 400 years. The author points out, however, that the ever-higher temperatures man is able to achieve.

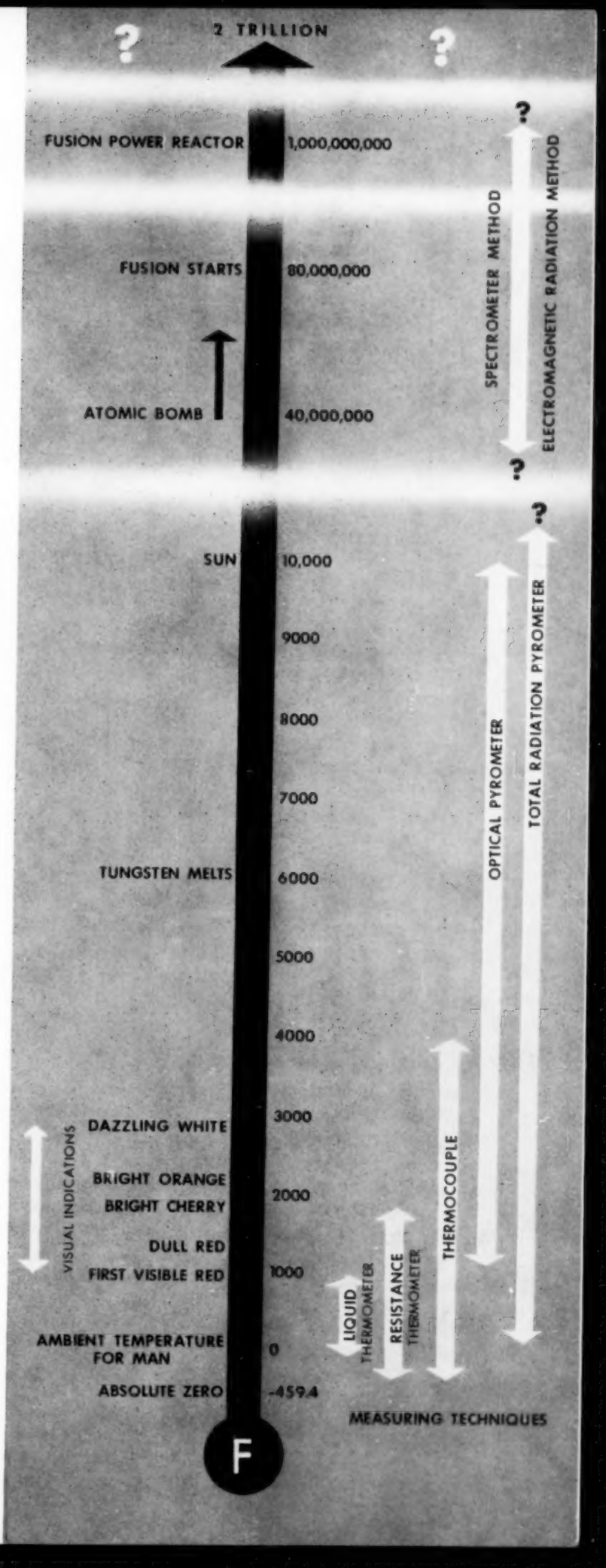
couples are convenient to install because the wires and leads in the cold zone can be quite small and are useful in measuring to perhaps —400 F.

Siemens tried a platinum resistance thermometer in 1871 which has proved useful in registering temperatures even lower than those that can be measured by thermocouples. The resistance thermometer depends upon the change in electrical resistivity of a material with temperature. Strange things happen in materials as their temperature becomes extremely low. One phenomenon is that the temperature coefficent of reistance of a metal approaches zero at the liquid helium region (—452 F). In practice, resistance thermometers made of 5 per cent lead in silver are quite accurate to within the temperature range from —445 to —452 F. Unannealed phosphor bronze has a measurable change in coefficient of resistivity down to about —457 F. Below —452 F, however, temperatures are usually measured in terms of the vapor pressure of helium using various empirical formulas.

Measuring Elevated Temperature

Moving upward from body temperature there is no generally accepted upper limit to temperature although some have suggested a limiting value of the order 2×10^{12} F (2 trillion degrees F).

The story of man's ability to measure elevated temperatures is much the same as for subnormal temperatures; the achievement of high temperatures spurred the need for their measurement. Melts of metals were being made long before the means for measuring their temperature were available. Iron workers developed great skill in determining the right time to pour their melts by judging the color of the hot metal. Such skills are not needed in today's mills where pours are made when temperature-measuring devices dictate.



1591? GALILEO

The advent of the gas turbine, various types of ram jet engines, and rocket propulsion devices has presented man with ever higher tempeartures to be measured. His latest excursions into high temperatures have also included experience with the tremendous amounts of heat and the resulting high temperatures attendant upon the fission and fusion of atoms.

Nature of Heat

To understand our difficulties in measuring high temperatures one must understand something about heat. Heat is a form of energy stored in a material as molecular motion. The more heat in a material, the faster the molecules move and the higher its temperature. The molecules in a solid are the least mobile, in a liquid they are more mobile, while their mobility is greatest in a gas. If heat is added to a solid at room temperature, its molecules vibrate faster as it warms. At some point, the molecules break their mutual attraction, becoming even more mobile, and a liquid is formed. As the liquid is heated to higher and higher temperatures the molecules break free and the liquid becomes a gas. The temperatures at which materials becomes vapors or gases vary widely. For example, at atmospheric pressure, helium changes from a liquid to a gas at —452 F while tungsten vaporizes at about 10,650 F. In most cases, when measuring temperatures where materials are vapors, the scientist must use methods different from those he uses to measure low temperatures.

Heat is generally defined as energy that is being transferred from one body to another in a direction from the hotter body to the cooler body. This transfer of heat energy can be by conduction, convection, or radiation or a combination of these.

Contact Methods

The two general methods of temperature measurement are referred to as contact and radiation. In contact methods, the sensing element is usually at the same temperature as the material whose temperature is being measured. These methods usually depend on conduction and include expansion, pressure, or resistance thermometers and thermocouples. In the radiation method, the sensing element is usually much cooler than the material being measured.

The use of contact methods of temperature measurements is restricted to perhaps 4000 F. Within this range, mercury-filled thermometers can be used to about 700 F without pressurizing and to 1000 F in the "pressure spring" type of thermometer. The industrial type of resistance thermometer can be used to about 1800 F.

The upper temperature limit for thermocouples depends, of course, on the thermocouple material. The platinum-platinum, 10 per cent rhodium thermocouple can be used to about 2900 F in an oxidizing atmosphere. With a higher rhodium content of 20 and 40 per cent in the platinum, the limit is raised to about 3350 F. The iridium, iridium-rhodium thermocouple can be used to 3600 F depending on its composition. The tungsten-molybdenum thermocouple reportedly can be used to about 4300 F. Use of these high-temperature thermocouples is complicated by their instability and change of calibration. In many thermocouple installations the maximum temperature that can be measured is determined by the thermocouple protection material and not the thermocouple itself.

Gas thermometers, which also measure by contact, have been used to relatively high temperatures. J. Prinsep in 1828 made a gold-bulb thermometer with which he measured temperatures to somewhat below the melting point of gold (1945.4 F). Later C. S. M. Pouillet in 1836, H. V. Regnault in 1847, and H. L. Callendar in the 1880's extended the range of the gas thermometer many hundreds of degrees by using a platinum bulb.

Remote Methods

Optical methods of measurement start below the top level of contact methods but extend far beyond those limits. In 1892, H. L. Le Chatelier designed the first photometric instrument. L. Holborn and F. Kurlbaum, using a S. P. Langley invention, designed the first disappearing-filament optical pyrometer. In prin-

In his over fifteen years' experience at Battelle in the measurement of physical, and especially thermal properties of materials, Herbert Deem has cooperated in solving numerous challenging technical problems. During that period, largely as an outgrowth of atomic energy research, measuring the properties of hard-to-handle materials at ever higher temperatures has been required. He has participated in developing measuring techniques for use on irradiated materials of many types; pioneered methods for measuring heat conductivity of liquids; helped to extend the range of heat-content measurements in the ice calorimeter; and devised techniques for measuring the emissivity to near the melting points of high-temperature metals.

ciple an optical image of the hot surface is placed in the same plane as a tungsten filament. An observer sees through the eyepiece an image of the hot body crossed by the filament. Current through the filament is adjusted until the filament brightness matches that of the hot body image. The current flowing through the filament, then, is a measure of the hot body temperature. The range of the basic instrument is extended by the use of filters so that temperatures from about 1200 to 10,000 F can be measured. The optical pyrometer, of course, measures the apparent temperature of the hot body and not its true temperature. These may differ by an appreciable amount depending on the emissivity of the hot surface. In turn, the emissivity of the hot surface being measured depends on the material itself and the surface roughness. Standard correction tables are available for different emissivities, but one seldom knows the emissivity of the hot surface to better than 10 per cent. The accuracy of the optical pyrometer reading is good if it can be arranged to view the hot object under ideal or black-body radiation conditions.

Other types of remote temperature-measuring devices (thermal total radiation pyrometers) make use of radiant energy but do not depend upon the human eye with all of the possibilities of error. Such devices usually include some type of mirror and/or lens optical system to collect and focus radiant energy from the hot source onto a sensing element. This sensing element usually changes temperature in some proportion to the hot object but only over a small range. The temperature of the sensing element is measured or recorded by standard means and translated into temperature of the hot body by the calibration of the instrument.

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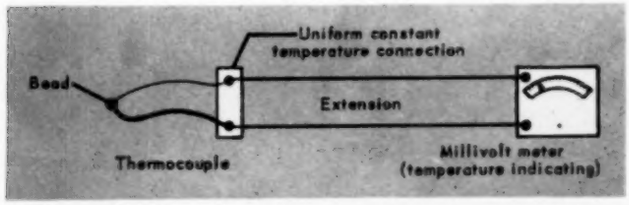
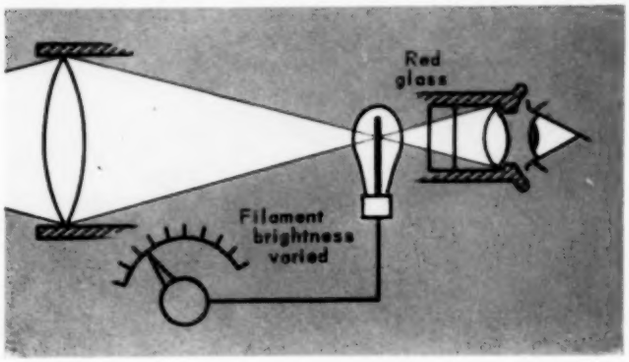
REY

The receivers in most radiation pyrometers consist of a thermocouple or thermopile (several thermocouples in series) with the radiation to be measured being concentrated on the hot junctions while the cold junctions are at the temperature of the housings. The emf output of the thermocouples can be translated into temperature of the radiating surface by using the calibration of the instrument. Another type of total radiation pyrometer makes use of a photo tube and control circuit to measure the radiant energy falling on it.

The temperature range of total radiation pyrometers can be greatly extended by the use of filters and/or diaphragms to control the level of energy falling on the sensing element. In general, the temperature range covered by this type of pyrometer is from 200 F up.





Diagrams of widely-used instruments for measuring temperature. The thermocouple (above) depends upon a generated voltage for indicating temperatures. It is useful to about 4300 F. The optical pyrometer (below) determines temperatures through measurement of the current required to light a filament to a brightness matching the heat source. The pyrometer has a range extending from about 1200 to about 10,000 F.

Looking to the Future

The search for more precise methods of temperature measurement goes on. The great challenge to scientists at this time is the tremendous temperatures associated with fission and fusion in the atomic energy field. As the following paragraphs suggest, some pioneering work on measuring temperatures in millions of degrees has taken place.

The advent of the hydrogen bomb and man's ambition to produce energy by controlled fusion of deuterium atoms with tritium atoms (heavy isotopes of hydrogen) have introduced very high temperatures into the picture. The prize for a successfully controlled fusion reactor will be an abundance of cheap power. There is enough deuterium in the waters of the earth to supply the world's present demand for power for 20 thousand million years. The deuterium in one gallon of water weighs about ⅓ gram and can be extracted for less than 4 cents, but this amount, if burned in a fusion reactor, will produce power roughly equivalent to 300 gallons of gasoline. The nuclear reactions of deuterium are known and the deuterium fusion reaction judged by nuclear standards is an easy one requiring a relatively mild collision. The temperature required to produce fusion is of the order of 80 million F for deuterium with tritium and 700

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million F for deuterium with deuterium. It is estimated that temperatures in a fusion reactor would have to be 1000 million F to balance out heat losses and get a machine that would supply more power than was used to run it. Britain claims to have attained in their ZETA (zero energy thermonuclear assembly) temperatures from 5 to 10 million F and expects to extend this to 50 million degrees with improvements now being made. Project Sherwood under way in this country should soon be reporting temperatures somewhat higher than this. Princeton's C. Stellarator is supposed to reach 90 million when completed in 1960.

Measuring temperatures in the millions of degrees presents real problems. One optical measuring method makes use of a spectrometer to measure the speed of the nuclei, which at these temperatures are continually gaining and losing electrons. In doing this, the nuclei emit light of a frequency depending on the speed of the source. The spectrograph picks up the random moving nuclei which produce a broadened line because of the Doppler effect. The width of the line is used to estimate the mean speed of the nuclei, hence their mean temperature. Optical methods such as spectroscopy and photography are useful for measuring plasma (ionized gas) temperatures up to several million degrees. At higher temperatures than those, the high purity plasma is essentially completely ionized and emits relatively little visible light.

One nonoptical method probes the plasma with a beam of high frequency electromagnetic radiation (microwaves). The amount of phase shift, absorption, and scattering of the microwave signal is an indication of the plasma temperature. Also electron temperatures can be deduced from microwave "noise" emitted from the plasma.

These and other plasma diagnostic techniques are being used to measure high temperatures. While any one method may be limited in accuracy or usefulness, the knowledge gained from one method supplements and extends that gained from others. It would seem that man's ingenuity in measuring high temperatures is equal to the present need. What will the future bring as man pushes temperatures into the hundreds and thousands of million degrees? Judged by the history of his ability to meet temperature-measuring needs there can be but one answer—man's ingenuity will be tried but not found wanting.

THROUGH SCIENCE, IMAGINATION SETS OUR LIMITS

"As man's understanding deepens, his environment grows ever more responsive to his wants; the world's resources become as rich as his imagination. Does our appetite for metals at last exhaust the abundant ore beds of the world? According to Harrison Brown and his associates at the California Institute of Technology, we may turn to the granite of the continental masses and extract not only the full spectrum of mineral wealth but the fissionable elements that will provide the energy to power this 'Age of Granite'. Or we may turn to the oceans, with their limitless supply of hydrogen for energy, plus all of the minerals leached out of the continental rock by the rains and rivers. Do we require food? According to studies by the Food and Agricultural Organization, we can, with sufficient investment, expand the world's arable land seven times. The output of the land may meanwhile be multiplied past any prediction by the manipulation of life processes in plants and animals. Beyond the land lie the seas in which the major portion of the earth's organic matter is turned over in the great interlocking cycles of life."

Gerard Piel

Coated Powders Provide Unique Materials

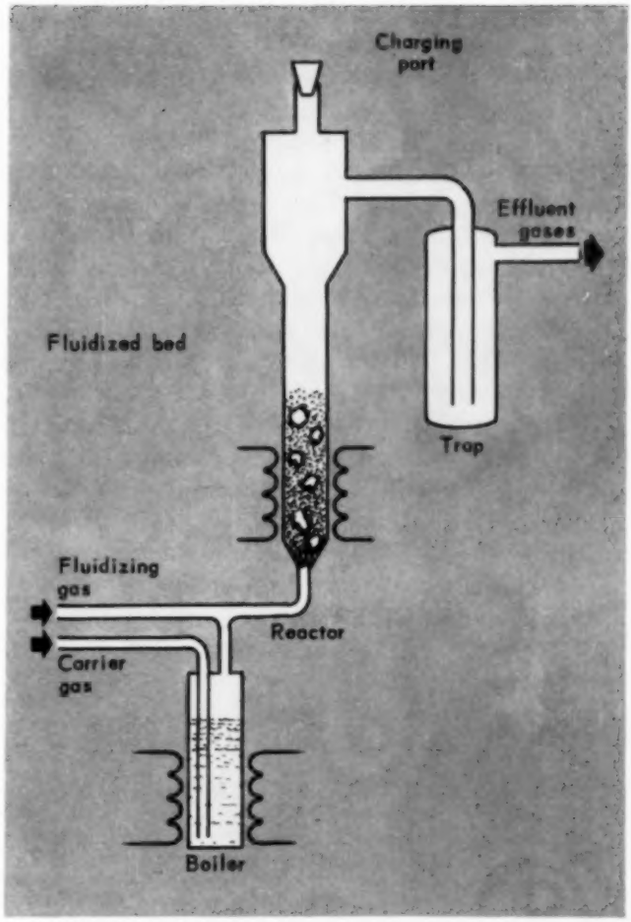
Metallic and ceramic-coated powders promise valuable new materials for structural and other purposes. The authors discuss methods of producing such powders and their potentialities in nuclear technology, aircraft construction, and catalytic processes.

by JOSEPH H. OXLEY *and* JOHN M. BLOCHER, JR.*

THE EXPLORATION OF MATTER in the solid state has provided our present society with a multitude of materials for use in construction, communications, transportation, and defense. In the early stages of civilization, man was limited to the natural materials, such as wood, stone, clay, pelts, and ice, which were readily available for his use. However, as the intelligence of man developed and he became more ingenious, he began to develop synthetic materials with new and unusual properties.

Once man produces a better synthetic material, he begins to look for possible new applications. Then, when a new use is discovered, efforts are made to develop an even better synthetic material. As a result of this interrelation of research and applications with respect to materials, progressive industries have been assured of continued growth.

*The authors gratefully acknowledge the help of J. F. Hannah, N. D. Veigel, D. A. Kizer, R. D. Buchheit, R. Palmer, E. E. Rose, C. T. Price, and others of the Battelle staff who have contributed to the development of the powder-coating technique reported here.



1. *The basic equipment required for the fluidized-bed process for coating particles with metal or ceramic films is shown in this schematic diagram of laboratory apparatus.*

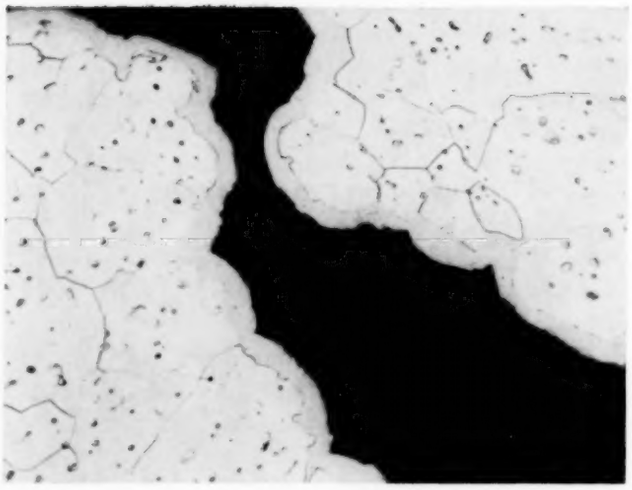
Coated powder is an example of a general class of new materials which was developed as a result of research directed toward specific applications.

In 1928, J. Gross and S. R. Zimmerley published the results of some studies on grinding that they had carried out for the Bureau of Mines. In order to determine the surface areas of the quartz powders used in grinding studies, they coated the quartz powder with thin, uniform films of silver. A modified mirroring solution was used to prepare the strongly adherent silver coatings. Sherritt Gordon Mines, Limited, has recently announced the development of an alternate wet process for coating powders with metallic films. The process is based on the deposition of metals from aqueous solutions under an atmosphere of pressurized hydrogen. The metals which can be deposited include cobalt and nickel. This process is relatively new and it may be possible to deposit other metals by use of other chemical systems.

A number of years ago, J. E. Cline and J. Wulff at

Massachusetts Institute of Technology endeavored to develop an improved cermet (a material consisting of a mixture of ceramic and metal phases) for high-temperature applications. They arrived at the rather novel idea of coating ceramic powders with thin metallic films by a fluidized-bed vapor-deposition process and then using powder-metallurgy techniques to fabricate parts from these coated powders. They discovered that relatively coarse silica sand could be coated with molybdenum. However, difficulty with iron and nickel films was encountered as a result of sintering of the coated particles or co-deposition of carbon. In addition, they found that fine (-325 mesh) powder was very difficult to coat because of the agglomerating tendency of the fine particles. Reactions of titanium carbide powder with the gaseous molybdenum compound used for plating also resulted in an unsatisfactory product.

Over the past several years, Battelle has been actively investigating the fluidized-bed deposition of refractory metals on "seed" metal particles as a method of commercially producing high-purity metals. In order to study the mechanism of deposition, a metal other than being deposited was used as the "seed" material. Thus, the characteristics of the deposited metal and the efficiency of deposition were readily determined by metallographic and chemical techniques. An example of these metal-coated metal particles is shown in Figure 2.



2. *Photomicrograph showing a metal film deposited on molybdenum powder by hydrogen reduction of a metal chloride in a fluidized bed. The fluffy-appearing film can be seen on each side of the dark background dividing the particles.*

It is now known that most metals can be deposited by vapor-deposition techniques as thin films on many different types of metal and ceramic powder bases and, furthermore, it has recently been demonstrated that ceramic films can also be deposited on such powder bases. Despite the early difficulties encountered with this fluidized-bed process, many of the processing problems have been solved or avoided, and now a major task of research is to find applications where the unusual properties of such coated materials may be utilized most effectively.

Description of Fluidized-Bed Process

A typical apparatus used in preparing these coated powders is shown in Figure 1. The reactor is a cylindrical vessel, frequently constructed with a conical-shaped bottom. The powder to be coated is charged through the top of the reactor. Hydrogen is the most common fluidizing gas because of its frequent use as a chemical reactant in the deposition of the coating material. The upward-flowing fluidizing gas supports the bed of powder and, as a result of the density difference between the fluidizing gas and the solid powder, the fluidized bed is maintained in a high

Joseph Oxley has been participating in the development of new processes for the production of high-purity metals. He has been especially interested in the use of hgh-temperature fluidized bed and vacuum techniques for that purpose. Prior to his association with Battelle, he aided in the design of in-pile radiation experiments in Westinghouse's Atomic Power Division and studied catalytic processes for petroleum in Gulf Oil laboratories. His doctoral studies in chemical engineering at Carnegie Institute of Technology culminated in a thesis on "Reactions of Sulfur During Gasification of Coal".

John Blocher has conducted and supervised varied studies involving the preparation of metals, often by unconventional techniques. This research has included preparation of high-purity metals by the reduction of their halides and of refractory coatings by vapor deposition. Among the metals involved have been chromium, columbium (niobium), molybdenum, tantalum, titanium, tungsten, and zirconium. A recent study led to an improved process for coating graphites with carbides. Blocher has also engaged in extensive determinations of the thermodynamic properties of inorganic materials, among them the halides of titanium and chromium. Chief of Battelle's inorganic chemistry and chemical engineering division, he is author of a score of publications and is divisional editor for electrothermics and metallurgy of the *Journal of the Electrochemical Society.*

degree of agitation. Consequently, all the particles present in the reactor are in constant motion, assuring uniform treatment by the plating gas. The fluidized powder is heated to a temperature level where the selected chemical reaction will proceed at a sufficient rate to permit an economical processing operation.

The choice of the reaction employed in the coating process varies with the material to be deposited and the chemical reactivity of the powder base. In the deposition of metal coatings, hydrogen reduction of the chloride is the preferred reaction, since the chloride is frequently the least expensive volatile form of the metal. However, in many cases, the chlorides are too stable or nonvolatile, and other reactions must be devised. Pyrolysis of iodides, carbonyls, nitrosyl carbonyls, carbonyl halides, alkyls, and reduction of bromides, iodides, and some metal oxides also are useful reactions. Metal halide feeds are also suitable for the preparation of ceramic films of carbides, oxides, borides, sulfides, nitrides, silicides, and hydrides. In these cases, an additional reacting gas must be supplied to bring about co-deposition of the carbon, oxygen, boron, sulfur, nitrogen, or silicon.

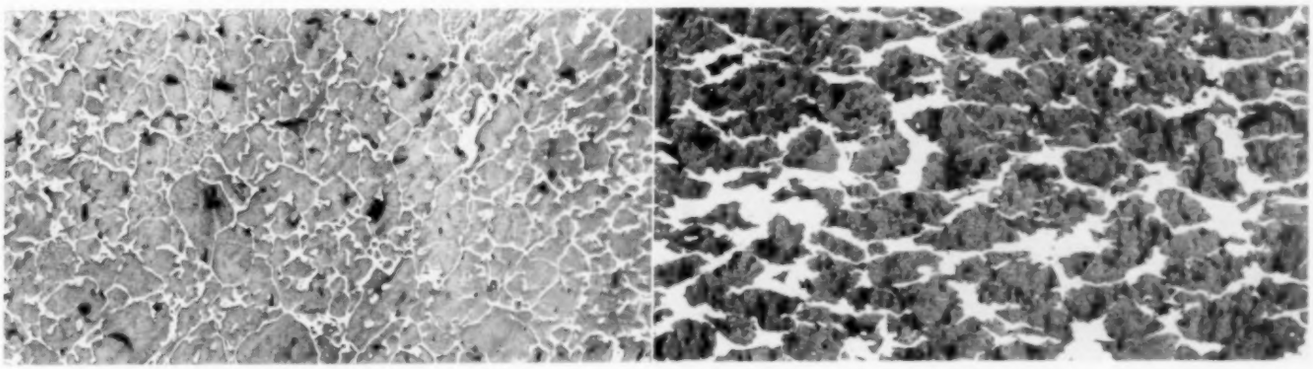
The process is simple not only in principle, but in practice. The volatile metal-coating compound is vaporized from a boiler or sublimer at a controlled rate, and the off-gases from the reactor are analyzed, scrubbed, and either recycled or discarded. After a predetermined length of time (depending upon the rate of deposition, the amount and size of powder being coated, and the desired thickness of the deposited film), the feed is stopped, the product discharged, and the reactor is recharged with another batch of powder. The turn-around time on a commercial unit should be only a few minutes, resulting in a very high on-stream factor. The process is not limited to the deposition of a single component. Alloys or ceramic phases can be deposited either as separate layers or in an isotropic film.

Applications in Nuclear Technology

The first large-scale interest in these coated powders has been expressed by the United States Atomic Energy Commission. It is believed that substantial contributions can be made in the field of nuclear technology by using precoated nuclear fuel particles in the development of improved fuel elements. The fuel element is the heart of the nuclear power plant, for it is in the fuel elements that the fission of uranium occurs by a carefully controlled reaction between neutrons and the uranium. Intense heat and high levels of radiation are generated within the fuel element.

There are a considerable number of problems associated with developing a low-cost fuel element which (1) is resistant to radiation damage, (2) assures the most efficient use of the available neutron supply, (3) permits the rapid removal of heat at high temperature in a minimum of reactor volume, (4) is not subject to corrosive attack by the coolant fluid, (5) retains the highly radioactive products of the fission reaction within the element, and (6) can be readily replaced by fresh elements after the uranium charge has been depleted. The most common type of fuel element consists of pelletized uranium dioxide powder which is enclosed in a metallic jacket. However, many other systems are being investigated, and some of these other systems are currently being employed.

The use of metallic-coated ceramic fuel powders in present and future nuclear reactor concepts should result in a number of distinct advantages. It is quite probable that an increase in the thermal conductivity of the fabricated element can be realized by using metallic-coated powder as the core material in the fuel element. It is believed that fission product retention can be considerably improved by precoating the fuel particles. Chemical or physical interaction between the fuel material and other materials in the reactor could

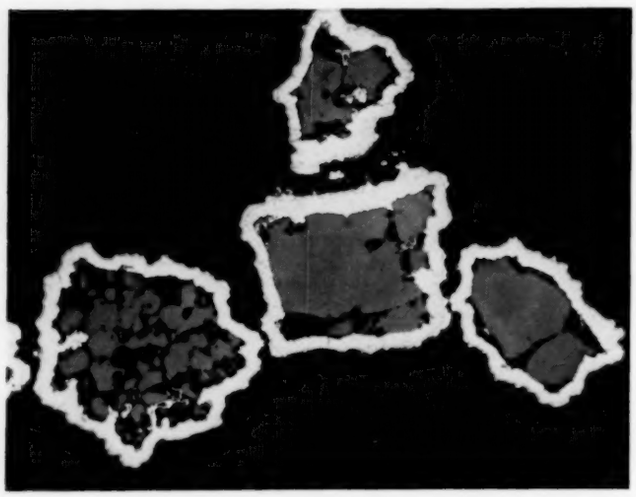


3. *Photomicrographs showing differences in structures obtained by hot pressing precoated powder (left) and a mixture of metallic and ceramic powders (right). The light-colored metal coating, which can be distinguished around each grain (on the left), gives a structure stronger than that resulting from pressing a mixture of powders.*

be avoided or minimized by precoating the powdered fuel with a suitable diffusion barrier. Burnable poisons could be deposited on the powdered fuel or co-deposited in the metallic film. (Burnable poisons are neutron absorbers which gradually disappear with continued radiation, thus compensating for depletion of the fuel and also the build-up of fission poisons, and thereby maintaining the power output of the reactor relatively constant for long periods of operation.) In addition, the strength of fuel elements made from metallic-coated ceramic fuel powders should prove superior to the strength of those made from ceramic powders or mixtures of ceramic and metallic powders. The improved structure of the fuel element obtained by substituting precoated powder for a mixture of ceramic metallic powders is shown in Figure 3.

The ability to precoat fuel powders with a uniform, continuous, and adherent protective film by an inexpensive vapor-deposition process may eventually eliminate the necessity for the relatively expensive cladding techniques that are presently employed in the fabrication of many types of fuel elements. These pre-clad powders can be hot pressed and probably could be extruded or rolled into suitable shapes for use in several types of reactors. The only uncertainty in such a scheme is the coating thickness required to assure complete encapsulation of the ceramic fuel in the fabricated element. In some of the newer design concepts based on a slurry or fluidized system, the coated particles themselves would be the ultimate form of the element.

A rather extensive program is currently being directed toward the development of processes for precoating nuclear fuel particles and for subsequent fabrication of these coated powders into fuel elements. Tungsten-, niobium-, and chromium-coated uranium dioxide powders have been prepared, and the niobium-coated material has been fabricated into cores. The tungsten powder-coating process proved fairly successful even when uranium-dioxide particles a few microns in diameter were employed as the base.



4. *Greatly magnified nuclear fuel particles which have received a duplex coating. The very fine lines dividing the two films can be seen near the outside of the heavy white lines surrounding the particles.*

Further studies are currently being conducted on other systems, including both ceramic and metallic films. An example of some work done on duplex coatings is shown in Figure 4, where a fission product retention film was first deposited upon a nuclear fuel particle, and then a diffusion barrier was subsequently deposited to prevent inter-reaction between the fission product-retention film and other materials in the reactor system.

Applications in Aircraft Construction

One of the most severe problems currently facing the designers of aircraft and missiles is the need for a lightweight material of construction for use at elevated temperatures under oxidizing conditions. Materials which have useful strength at high temperature generally have poor oxidation resistance. Conversely, those materials which are oxidation resistant frequently do not have sufficient strength. Those few materials which are both oxidation resistant and have some degree of high-temperature strength, such as alloys of the precious metals, are very costly. In addition, almost all the more promising candidates for these applications are relatively dense materials. The use of coated powders in such applications certainly does not eliminate all aspects of the problem, but it does provide another degree of freedom in selecting combinations of materials with tailored properties.

As an example of this approach, less oxidation-resistant powdered materials could be coated with thin films of platinum or platinum alloys and fabricated into the desired shape by powder-metallurgy techniques. Any failure of the initial surface of precious metal alloy due to melting, erosion, or other mechanical phenomenon, would be localized. The matrix material would limit this penetration of the surface to a depth equivalent to the diameter of the original starting powder. The material to be encapsulated in the protective matrix could be selected on the basis of properties quite apart from oxidation resistance, such as light weight, high heat capacity, high strength, high melting point, high effective thermal conductivity, or the ability of the material to undergo a heat-absorbing reaction at intermediate temperature levels.

The use of a suitable heat-absorbing reaction to attenuate the heat generated by the frictional resist-

ance of the atmosphere to the high-speed flight of the missile or aircraft is not limited to a precious-metal matrix system. Other less costly matrix materials may serve equally well. Reactions which might prove to have useful heat-absorbing properties include pyrolysis of salt-like or interstitial metal hydrides and possibly pyrolysis of metal carbonates, reaction of metal oxides to form carbides, and physical reactions such as melting or other types of phase transitions.

Consideration should also be given to the use of coated powders in the preparation of an inexpensive, lightweight, honeycomb structure for the reinforcement of aircraft parts. Thin-walled hollow ceramic spheres are currently being produced by a number of manufacturers. These spheres have been coated with thin metallic films and can, for instance, be injected into the void sections of an airframe. It is believed that by heating this lightweight coated material to its sintering temperature, a low-cost castable, honeycomb-type reinforcing structure could be prepared.

Applications in Catalytic Processes

Solid catalysts are frequently employed in the petroleum and chemical process industries to accelerate a specific reaction or series of consecutive chemical reactions. Many chemicals which are widely used industrially are economically feasible because of the development of catalytic processes for their production. Most catalysts are supplied in a form consisting of a solid support material and one or more catalytically active metals or metal compounds. The production of such supported catalysts generally involves one or more of the following operations: impregnation, purification, mixing, fusion, leaching, and evaporation.

The use of the impregnation technique usually provides a satisfactory catalyst, but it is generally recognized that nonuniform distribution of the catalytic agent frequently occurs during the impregnation or during a subsequent drying or calcining operation. Precipitation can frequently be used to prepare relatively active multicomponent catalysts, but careful control over the various precipitation, washing, and calcining operations must usually be observed. In addition, a significant part of the active catalytic component is embedded within the support material, resulting in inefficient use of the catalytic agent.

The use of mixing, fusion, and leaching operations is normally restricted to the preparation of rather specific catalysts, and these methods are probably not as important industrially as are the impregnation and precipitation techniques. Preparation of very pure catalytic metallic films by high-temperature thermal evaporation has been investigated experimentally, but the results of these laboratory studies have never been successfully transformed into a practical commerical operation. However, by the use of suitable reducing agents and relatively unstable volatile metallic compounds, such catalytic films can now be deposited on suitable granular supports at low temperatures at a very nominal cost by the previosuly described powder-coating technique.

The catalyst produced by this technique could consist of either a thin uniform film of the catalytic agent upon the support powder, or a highly irregular deposit with high specific surface areas. The nature of the deposit is a function of the type of feed material and the temperature of the fluidized-bed deposition process. Co-deposition of multicomponent catalysts could also be carried out commercially.

There is already a limited amount of evidence that this production technique for catalysts is beginning to receive industrial attention. One recent patent covers the use of nickel carbonyl for depositing a catalytic nickel film on a suitable powdered support material, and in another, claims are made for the use of volatile molybdenum trioxide for depositing a molybdenum suboxide catalyst on a granular support material.

Because these coated powders can be produced at a low cost, and since the films are deposited only on the surface of the carrier material where it can be most efficiently utilized catalytically, the development of fluidized-bed vapor-deposition processes for production of catalytically active coated powders will undoubtedly receive increasingly attention in the future.

Conclusions

The combination of vapor deposition and fluidized-bed technologies has made available a wide variety of coated-powder combinations. Some of the uses now under development have been discussed. However, the full exploitation of these interesting composite materials awaits the exercise of additional ingenuity.

Nuclear reactors of the future will benefit from the cladding of individual fuel particles. Supported catalysts of improved properties are expected to result from this powder-coating technique. Atmosphere reentry problems may find a solution in heat sinks fabricated of appropriate coated-powder systems. The commercial opportunities for using coated powders in electronic devices, thermal insulators, abrasives, solid propellants, powder metallurgy, and other applications are believed to be substantial. In short, it is believed that technologists in most fields would benefit by considering the applicability of coated powders for solving some of their materials problems.

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Radiation Effects on Insulation, Wire, and Cable. C. J. Lyons and R. I. Leininger. *Insulation*, v. 5, May, 1959, pp. 19-26.

The authors provide an excellent summary of available information regarding radiation effects. Although each insulation material is discussed in as brief a manner as possible, nearly all significant points are covered. This article deals with radiation effects produced by γ-rays and fast and slow neutrons on specific elastomers and plastics.

Tantalum (V) Bromide. D. H. Nowicki and I. E. Campbell. Paper from "Inorganic Syntheses", v. IV, pp. 130-133, McGraw-Hill, New York.

Tantalum (V) bromide may be prepared by bromination of tantalum carbide or mixtures of tantalum (V) oxide and carbon It is most conveniently prepared by reaction between the elements, either at atmospheric pressure, using an inert carrier gas, or *in vacuo*. The reaction of Br vapor with tantalum powder in a nitrogen atmosphere forms the basis of the procedure outlined. Properties are also described.

Radioisotopes Utilization in the Foundry Industry. M. Pobereskin and D. N. Sunderman. *Modern Castings*, May, 1959, pp. 69-74.

Applications of radioisotopes in the metals industry, while relatively few in number, have contributed measurably to an improved product and a better understanding of the processes involved. These applications include measurement of wear of cutting tools, bearings and refractory surfaces, tracing of chemical and physical species through complex processes, measurement of thickness of solid and fluid metal and surface coatings, corrosion, location of alloying elements in microstructure and the diffusion of metals in alloys.

Factors Affecting Sinterability of Oxide Powders: BeO and MgO. John F. Quirk. *American Ceramic Society, Journal*, April, 1959, pp. 178-181.

Data on the sintering of BeO and MgO were reviewed with reference to the diffusion sintering model devised by Kuczynski and Herring. Sintering rates for compacts of the dead-burned oxide powders were in agreement with the bulk diffusion model with grain-boundary sinks, but those of the active low-calcined powders had very high initial shrinkages, after which the shrinkage rate was low, corresponding to a rate index of about 10.

Progress in the Development of Fuel Elements. Howard W. Russell. Paper from *Power Reactor Conference. Proceedings of a Meeting Held November 26, 27, 28, 1956, at Fabrimetal, Brussels, Belgium*, pp. 162-165. Atomic Industrial Forum, New York.

Reviews developments of the last 15 years beginning with the proposed use of "Tuballoy", which soon proved inadequate because of coolant contamination. Electroplated coatings were then tried, followed by Al cladding, Al-Ni alloys, Be sheet, stainless steels, and Hf-free Zr and the Zircalovs. Modification of the fuel is also developed.

Development of Accelerated Life Test Procedures for Carbon Composition Resistors. B. C. Spradlin and H. M. Braner. Paper from *Proceedings of the Fifth National Symposium on Reliability & Quality Control in Electronics*, The Institute of Radio Engineers, Inc., New York, 1959, pp. 307-318.

After reliability information has been obtained from simulated-use life tests on component parts, the question of the reliability of future production lots of components remains to be answered. This paper describes a 1000 hour exploratory accelerated test for ½-watt carbon composition resistors. A method of statistically testing to determine if true acceleration was achieved is illustrated using text data obtained. Recommendations for further development are included.

The Technology of Commercial Elastomer-Based Adhesives. (In German) Die Technologie industrieller Kleber auf Elastomerbasis. J. Szurrat. *Bitumen, Teere, Asphalte, Peche*, March, 1959, pp. 102-106.

A study of adhesives, historical background and present needs; their two types, respectively based on solutions in organic solvent and on aqueous emulsions, their structure, the properties of rubber-based adhesives, solubility of some elastomers in different solvents, the stabilizers, catalysts and fillers; the use of both types of adhesives.

Significant Trends for Printing Production. J. Homer Winkler. *Share Your Knowledge Review*, April, 1959, pp. 3-6.

Discusses future developments in the printing industry, all tending to faster, more efficient production. It is going to be necessary for printing management to pay more attention to long-range planning within the industry. Many policy decisions regarding equipment, facilities, and methods will have to be made in the near future. The important thing is for management representatives to utilize the information that has been supplied today and to have their decisions influenced by the ideas and convictions that have been expressed during this program.

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Effect of Residual Stress on Brittle Fracture. Hiroshi Kihara and Koichi Masubuchi. *Welding Journal*, April, 1959, pp. 159s-168s.

Japanese authors report the results of their studies on the brittle fracture of welded structures at low stress level.

Radiation Effects on Insulation, Wire, and Cable. C. J. Lyons and R. I. Leininger. *Insulation*, v. 5, May, 1959, pp. 19-26.

The authors provide an excellent summary of available information regarding radiation effects. Although each insulation material is discussed in as brief a manner as possible, nearly all significant points are covered. This article deals with radiation effects produced by γ-rays and fast and slow neutrons on specific elastomers and plastics.

Tantalum (V) Bromide. D. H. Nowicki and I. E. Campbell. Paper from "Inorganic Syntheses", v. IV, pp. 130-133, McGraw-Hill, New York.

Tantalum (V) bromide may be prepared by bromination of tantalum carbide or mixtures of tantalum (V) oxide and carbon It is most conveniently prepared by reaction between the elements, either at atmospheric pressure, using an inert carrier gas, or *in vacuo*. The reaction of Br vapor with tantalum powder in a nitrogen atmosphere forms the basis of the procedure outlined. Properties are also described.

Radioisotopes Utilization in the Foundry Industry. M. Pobereskin and D. N. Sunderman. *Modern Castings*, May, 1959, pp. 69-74.

Applications of radioisotopes in the metals industry, while relatively few in number, have contributed measurably to an improved product and a better understanding of the processes involved. These applications include measurement of wear of cutting tools, bearings and refractory surfaces, tracing of chemical and physical species through complex processes, measurement of thickness of solid and fluid metal and surface coatings, corrosion, location of alloying elements in microstructure and the diffusion of metals in alloys.

Factors Affecting Sinterability of Oxide Powders: BeO and MgO. John F. Quirk. *American Ceramic Society, Journal*, April, 1959, pp. 178-181.

Data on the sintering of BeO and MgO were reviewed with reference to the diffusion sintering model devised by Kuczynski and Herring. Sintering rates for compacts of the dead-burned oxide powders were in agreement with the bulk diffusion model with grain-boundary sinks, but those of the active low-calcined powders had very high initial shrinkages, after which the shrinkage rate was low, corresponding to a rate index of about 10.

Progress in the Development of Fuel Elements. Howard W. Russell. Paper from *Power Reactor Conference. Proceedings of a Meeting Held November 26, 27, 28, 1956, at Fabrimetal, Brussels, Belgium*, pp. 162-165. Atomic Industrial Forum, New York.

Reviews developments of the last 15 years beginning with the proposed use of "Tuballoy", which soon proved inadequate because of coolant contamination. Electroplated coatings were then tried, followed by Al cladding, Al-Ni alloys, Be sheet, stainless steels, and Hf-free Zr and the Zircalovs. Modification of the fuel is also developed.

Development of Accelerated Life Test Procedures for Carbon Composition Resistors. B. C. Spradlin and H. M. Braner. Paper from *Proceedings of the Fifth National Symposium on Reliability & Quality Control in Electronics*, The Institute of Radio Engineers, Inc., New York, 1959, pp. 307-318.

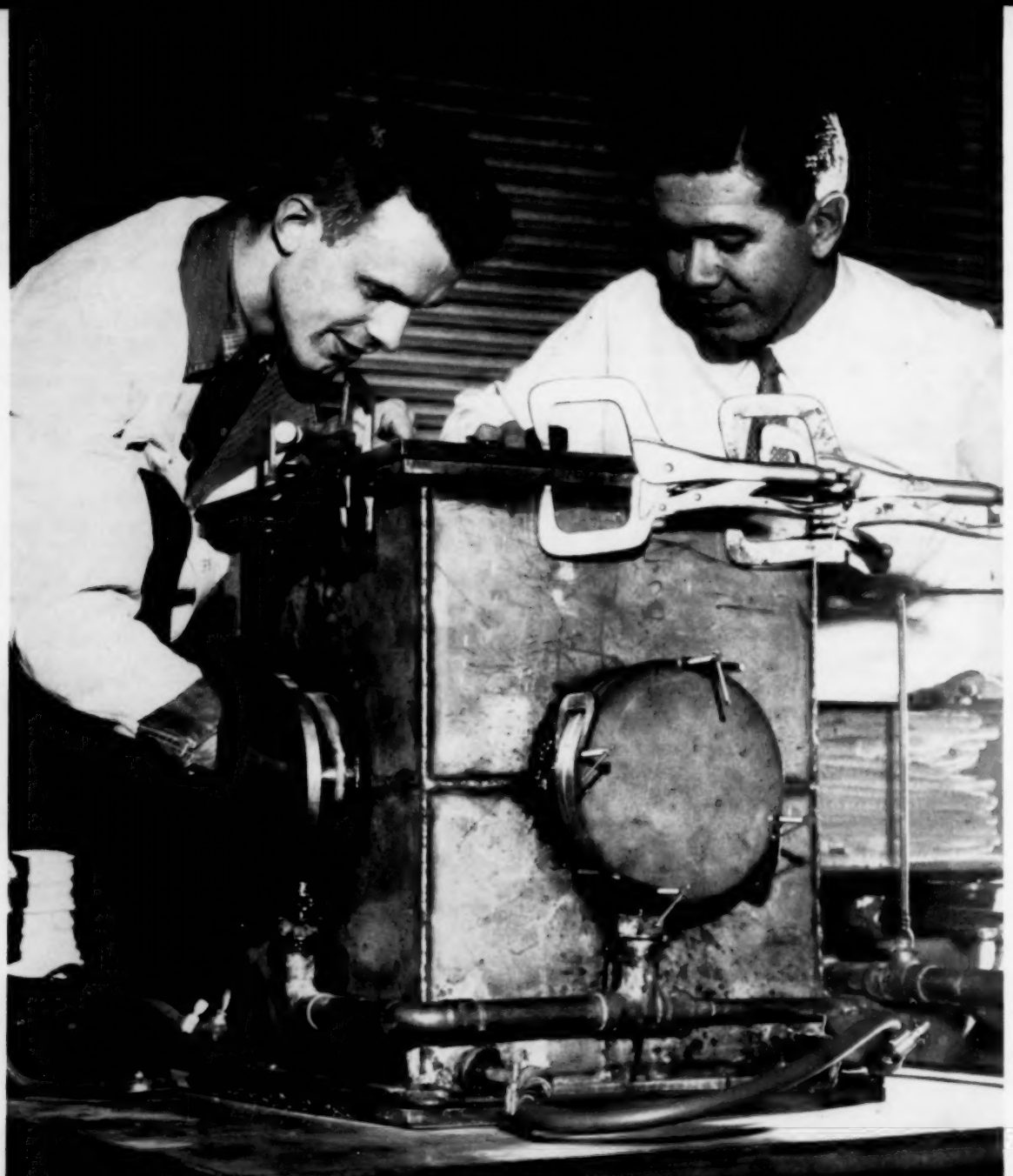
After reliability information has been obtained from simulated-use life tests on component parts, the question of the reliability of future production lots of components remains to be answered. This paper describes a 1000 hour exploratory accelerated test for ½-watt carbon composition resistors. A method of statistically testing to determine if true acceleration was achieved is illustrated using text data obtained. Recommendations for further development are included.

The Technology of Commercial Elastomer-Based Adhesives. (In German) Die Technologie industrieller Kleber auf Elastomerbasis. J. Szurrat. *Bitumen, Teere, Asphalte, Peche*, March, 1959, pp. 102-106.

A study of adhesives, historical background and present needs; their two types, respectively based on solutions in organic solvent and on aqueous emulsions, their structure, the properties of rubber-based adhesives, solubility of some elastomers in different solvents, the stabilizers, catalysts and fillers; the use of both types of adhesives.

Significant Trends for Printing Production. J. Homer Winkler. *Share Your Knowledge Review*, April, 1959, pp. 3-6.

Discusses future developments in the printing industry, all tending to faster, more efficient production. It is going to be necessary for printing management to pay more attention to long-range planning within the industry. Many policy decisions regarding equipment, facilities, and methods will have to be made in the near future. The important thing is for management representatives to utilize the information that has been supplied today and to have their decisions influenced by the ideas and convictions that have been expressed during this program.



FOR RESEARCH ON REFRACTORY METALS

Research has demonstrated that the electrorefining and electrowinning of refractory metals such as titanium, vanadium, and zirconium, not possible with conventional electrolytes, can be accomplished by electrolysis using fused salts. The new fused-salt electrolytic cell, similar to a Bureau of Mines unit, will be used at Battelle to investigate such processes. In electrolytic processing, the metal to be refined is placed in the electrolyte as the anode; and the metal (up to 99.99 per cent pure) is then deposited upon the cathode. To prevent contamination, the process is carried out in an inert gas atmosphere.

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ABSTRACTS

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AERONAUTICAL ENGINEERING

7347* Research Methods and the Full-Scale Test Aircraft. Relates test aircraft to the research effort, and tells of many notable research aircraft of the past and present. ***R. A. Cole.*** *Aeronautics*, v. 40, no. 2, Apr. 1959, p. 26-30.

7348 The Nike-Ajax Missile. Body of the missile is made up of several sections of cylindrical magnesium castings, machined aluminum forgings and fabricated stressed-sheet aluminum that are bolted together. The body obtains its strength from its outer walls, known as monocoque construction. ***L. H. Kellogg and P. C. Swan.*** *Bell Laboratories Record*, v. 37, Apr. 1959, p. 134-138.

7349 Means and Examples of Aeronautical Research in France at ONERA. ***Maurice Roy.*** *Journal of the Aero/Space Sciences*, v. 26, Apr. 1959, p. 193-206.

7350 The Tailored-Interface Hypersonic Shock Tunnel. This tunnel provides a means for producing the high Mach number, high stagnation temperature flow conditions encountered in hypersonic flight. Various gasdynamic phenomena associated with shock tunnels are discussed, and experimental evidence of the successful application of this technique is presented. As an indication of its research application, the results of heat-transfer experiments on a hemisphere-cylinder model are presented and compared with theory. ***Charles E. Wittliff, Merle R. Wilson, and Abraham Hertzberg.*** *Journal of the Aero/Space Sciences*, v. 26, Apr. 1959, p. 219-228.

7351 The Smallest Height of Roughness Capable of Affecting Boundary-Layer Transition. Critical heights for three types of roughness were found in a low-speed wind tunnel. The types were (1) two-dimensional spanwise wire, (2) three-dimensional discs, and (3) a sandpaper type. In addition to type of roughness, test variables included the location of roughness, pressure distribution, degree of tunnel turbulence, and length of natural laminar flow. The most satisfactory correlation parameter was found to be the roughness Reynolds number, based on the height of roughness and flow properties at this height. ***A. M. O. Smith and Darwin W. Clutter.*** *Journal of the Aero/Space Sciences*, v. 26, Apr. 1959, p. 229 + 17 pages.

7352 Hot Vacuum Cells Simulate High-Mach Stresses. Simulates the heat and loads of high-speed flight by using a series of new vacuum-heat-tension pads to produce heat and loads on the test wing. ***J. P. Moran.*** *Machine Design*, v. 31, Mar. 19, 1959, p. 22-23.

7353 Materials for Rockets and Missiles. Mechanical properties of sheet, wrought, and cast alloys, and cermets. Materials fabrication development. Comparison of lightweight, high temperature alloys. ***Robert G. Frank and William F. Zimmerman.*** 124 pp. 1959. The Macmillan Co., New York. (TL782 F85m)

7354 Metals Used in the Vanguard. Stainless steel, Al and Mg alloys, and Ti are employed in various areas of the vehicle. Future missiles will benefit from the evaluation of materials for this application. ***Charles Hirst.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 73-76.

7355 Hot Work Toolsteel for Aircraft. Used for many years in special dies, the 5% chromium toolsteels (H-11) are being accepted as a structural material in supersonic aircraft and missiles. Heat treatable to 280,000 to 300,000 psi tensile strength, the steel resists softening up to 925 F. Impact and fatigue strengths are also adequate. ***P. E. Ruff.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 103-107.

7356 Designed to Fly . . . . High. Jet airliners ("Comets") met disaster in 1954. New Comets use metal of higher endurance and slow crack propagation, and the design is based on thousands of fatigue tests on material, joints, members, subassemblies, and completed structure. ***Tom Bishop.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 108-111.

7357 Some Problems Associated With the Measurement of Very Low Pressures. Several types of pressure-sensitive elements now used in wind tunnels are described. A method of design for the connecting line joining an orifice to a pressure-

sensitive element is presented. The time response of the measurement system determined by this method is shown to be influenced by outgassing effects within the volume of the system and variable temperatures acting along the connecting line. Measurement of and correction for these effects are indicated. ***George J. Maslach.*** *North Atlantic Treaty Organization, AGARD Report No.* 175, Mar. 1958, 30 pp. (TL565 Ag11r Vis.)

7358 Aerodynamic Ablation of Melting Bodies. The ablation on a flat plate with a constant heat input is derived in detail. Also for this case, the ablation after heat shut-off is derived. Another case that has been studied is the ablation after a thermal pulse. A simple experiment was performed which ablates water from a slab, and the results of this experiment substantiate the theory qualitatively. ***Theodore R. Goodman.*** Paper from "Proceedings of the Third U. S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958. p. 735-745. (TA350 Un4p Over.)

7359 Hypersonic Stagnation Point Heat Transfer to Surfaces Having Finite Catalytic Efficiency. The use of "noncatalytic" coatings has been suggested as a means of reducing the heat absorbed by a hypersonic vehicle by minimizing the catalytic recombination of atomic species. The theoretical merits of such coatings are investigated by solving the governing system of nonlinear differential equations subject to the appropriate conditions of velocity, temperature, pressure and molar concentrations of reacting gaseous species, at the stagnation point of the body. The effects of homogeneous and heterogeneous atomic recombination are included and the results obtained yield the unique relationship between the catalytic efficiency of a surface and the heat transfer from the flowing dissociated gas which envelopes the vehicle. ***Sinclaire M. Scala.*** Paper from "Proceedings of the Third U. S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958. p. 799-806. (TA350 Un4p Over.)

7360 Exact Solution of the Neumann Problem. Calculation of Non-Circulatory Plane and Axially Symmetric Flows About or Within Arbitrary Boundaries. Solid-body, inlet and purely internal flow problems can be solved. Because the method is capable of dealing with several bodies at once in the presence of one another, problems of interference can be treated with ease. Boundaries need not be solid, that is, flows involving area suction can be calculated. With an IBM 704, calculations require from 3 minutes to 2 hours according to the complexity of the body. ***A. M. O. Smith and Jesse Pierce.*** Paper from "Proceedings of the Third U. S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958. p. 807-815. (TA350 Un4p Over.)

7361 Aerodynamics of Wings and Bodies at Mach Number One. A method is described for the approximate solution of the nonlinear equations of transonic flow theory for flows with free-stream Mach number one. Results in the form of pressure distributions are given for a number of specific applications involving air-foils, bodies of revolution, and slender bodies of arbitrary cross sections. All results are compared either with existing theoretical solutions or with experimental data. ***John R. Spreiter and Alberta Y. Alksne.*** Paper from "Proceedings of the Third U. S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958. p. 827-835. (TA350 Un4p Over.)

7362 Finite Cavity Cascade Flow. Steady flow of an incompressible, nonviscous fluid past an infinite array of lifting foils under such conditions that fully developed cavities appear on the foil surfaces is considered. The foils are taken to be thin and at small angle of attack so that the linearized theory of Tulin may be applied. The linearized problem is solved for any stagger angle and any chord-foil spacing ratio in terms of the cavitation number, cavity length, exit angle, and exit velocity. The effect of changing chord-foil spacing ratio on cavitation number, exit angle and lift coefficient is obtained as well as the relation between lift coefficient and cavitation number. ***C. D. Sutherland and Hirsh Cohen.*** Paper from "Proceedings of the Third U. S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958. p. 837-846. (TA350 Un4p Over.)

7363 Velocity Measurements in the Boundary Layer and in the Main Flow Between Two Coaxial Disks Rotating With Equal Velocities in Air. Velocity and pressure distributions were measured in subsonic air flow induced by the rotation of two coaxial disks moving with equal velocities. Disk rim Reynold numbers varied from 2.35×10^5 to 6.19×10^5 and the spacing between the disks was varied from 4 to 8 inches. Particular emphasis is placed on the measured radial and tangential velocities within the boundary layer, and these results are compared with values reported for a single rotating disk. ***William E. Welsh, Jr. and James P. Hartnett.*** Paper from "Proceedings of the Third U. S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958. p. 847-855. (TA350 Un4p Over.)

7364* Space Guide. Description of NASA facilities including organization and biographies of key officials; programs and plans of NASA; cooperative agreement on Jet Propulsion Laboratory and Army Ordnance Missile Command; outline of space exploration needs; NASA budget for 1960 and partial list of projects; contracting procedures and procurement offices; research program; patent provisions of Space Act; cost factors and ground facilities; Project Mercury; Rocketdyne (North American) building million pound thrust engine; new facts on shape of earth; United States aeronautical and space activities, President's Report to Congress; United States satellites, lunar probes and space probes, 1958. ***Vincent F. Callahan, Jr., editor.*** 173 pp. 1959. Vincent F. Callahan, Washington, D. C. (TL521 C13s Over.)

7365* The ABC's of Inertial Navigation. Fundamental principles of inertial navigation; operation of basic components. An elemental navigator is described first for movement on a straight course over a flat, nonrotating earth. Components are added in stages until a complete system is evolved for guiding a satellite rocket into an orbit. ***Emanuel Levinson.*** *Sperry Engineering Review,* v. 12, no. 1, Mar. 1959, p. 2-9.

7366* The Horizontal Integrating Accelerometer. Essential working principles of an accelerometer for inertial guidance applications. Sources of error and means for eliminating or minimizing them. Description of an assembled unit. ***Harry J. Smith.*** *Sperry Engineering Review,* v. 12, no. 1, Mar. 1959, p. 38-45.

7367 The Effects of Target and Missile Characteristics on Theoretical Minimum Miss Distance for a Beam-Rider Guidance System in the Presence of Noise. Target and missile motions are assumed to be coplanar. The factors considered are the missile natural frequencies and damping ratios, missile steady-state acceleration capabilities, target evasive maneuver characteristics, and angular scintillation noise characteristics. By means of a modified orthogonal-square analysis, a simple correlation equation has been derived which expresses the theoretical minimum miss distance as a function of the above factors. ***Elwood C. Stewart, Frank Druding, and Togo Nishiura.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 2-12-59A, Mar. 1959, 32 pp. (TL782 Un3rm Vis.)

7368 Study of the Oscillatory Motion of Manned Vehicles Entering the Earth's Atmosphere. Expressions for the oscillatory motion are derived as continuous functions of the properties of the trajectory. Results are applied to a study of the oscillatory behavior of re-entry vehicles which have decelerations that remain within limits of human tolerance. It is found that a deficiency of aerodynamic damping for such vehicles may have more serious consequences than it does for comparable ballistic missiles. ***Simon C. Sommer and Murray Tobak.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 3-2-59A, Apr. 1959, 30 pp. (TL782 Un3rm Vis.)

7369 Artificial Satellites. Laws of motion; engines; launching; construction; ground observation and communication; manned vehicles. ***A. Shternfel'd.*** *U. S. Office of Technical Services, PB* 141351T, 1958, 424 pp. (T21 Un3r Contin.)

See also: **7406** (glass and ceramics in aeronautic equipment); **7843** (metals in airframes); **7891** (atmospheric motion of meteoric bodies); **8071** (Co alloys for use in aircraft); **8190** (fabricating sheet metal for aircraft); **8418** (aircraft materials).

AGRICULTURE

7370* The Genetic Effects of Family Structure in Natural Populations. In this paper, the rate at which homozygosity is reached in the absence of mutation is found for a finite, dioecious diploid population whose generations do not overlap. The effect of family structure on this rate is investigated, and it is shown that the rate for a randomly mating population remains unchanged if there is permanent marriage (monogamy) amongst individuals. The determining factors are shown to be the variances of the number of offspring per individual of specified sex, and therefore the probability distributions of offspring are studied for several population models, and, in particular, are related to the birth and death rates for each individual of specified age. ***B. A. P. Moran and G. A. Watterson.*** *Australian Journal of Biological Sciences*, v. 12, no. 1, Feb. 1959, p. 1-15.

7371* The Effect of Certain Insecticides and Fungicides on Fungi Pathogenic to the Spotted Alfalfa Aphid. Certain insecticides and fungicides are toxic to the vegetative stages of some of the fungi that attack the spotted alfalfa aphid. Most susceptible to these materials was *Entomophthora exitialis* Hall & Dunn, the dominant pathogen of the aphid in California. Further tests have indicated that the insecticides do not kill the resting spores of *E. virulenta* H. & D. although germination is retarded to some extent. ***Irvin M. Hall and Paul H. Dunn.*** *Journal of Economic Entomology*, v. 52, no. 1, Feb. 1959, p. 28-29.

7372* The Employment of Exotic Entomophagous Insects in Pest Control. Effective entomophagous insects are usually derived from the native habitat of the host, provided that the host in that habitat exists at low population densities. The dominant entomophagous species obtained under such conditions is likely to be the most effective, particularly if it is host specific. Importations should be made from representative types of host environments, since no one species of entomophagous insect is likely to be effective throughout the range of its host. After establishment, artificial exposure of host populations provides a means of demonstrating the effectiveness of the entomophagous insect. ***Stanley E. Flanders.*** *Journal of Economic Entomology*, v. 52, no. 1, Feb. 1959, p. 71-75.

7373* Growth of Germ-Free and Conventional Chicks: Effect of Diet, Dietary Penicillin and Bacterial Environment. Chicks hatched and reared in the absence of bacteria and fungi grow 15 to 25% faster than conventional chicks on the same autoclaved casein-starch or soybean meal-corn diet. The increased growth rate is related to the fact that the germ-free chicks eat more than the conventional chicks. Better growth was obtained when potassium and calcium were provided in the diet in the form of potassium monophosphate and calcium carbonate rather than as calcium phosphate. The growth-promoting effect of dietary penicillin is shown to be due to a reversal of a transmissible growth-depression condition. ***Martin Forbes and James T. Park.*** *Journal of Nutrition*, v. 67, no. 1, Jan. 1959, p. 69-84.

7374* Biological Control Factors Influencing Populations of Oak Leaf-Miner, *Lithocolletis messaniella* Zeller, in New Zealand Including the Introduction of Parasites. ***B. B. Given.*** *New Zealand Journal of Agricultural Research*, v. 2, no. 1, Feb. 1959, p. 124-133.

7375 Gibberellins: Stimulants of Plant Growth. Surveys historical background, gibbellerin compounds, effects on stem length, flowering, absence of light, germination and growth of pollen, cell division, plant growth and metabolism, and affinities with auxin and kinetin. ***Bruce B. Stowe and Toshio Yamaki.*** *Science*, v. 129, Mar. 27, 1959, p. 807-816.

BIOCHEMISTRY AND BIOPHYSICS

7376 Advances in Virus Research. The following subjects are contained in this 6th volume of a collection about virus investigations; the purification of plant viruses, biochemistry of plant virus infection, the spread of plant viruses, the physiological aspects of bacteriophage genetics, the purification and properties of poliovirus, measles virus, the kappa and related particles of paramecium. ***Kenneth M. Smith and Max A. Lauffer, editors.*** v. VI. 382 pp. 1959. Academic Press, New York. (QR360 Ad95 Vis.)

7377* Effect of Chronic Gamma Irradiation Upon Blood in Mice. (*In Russian.*) Vliianie khronicheskogo gamma oblucheniia na krov' myshei. ***E. N. Kopylova.*** *Akademiia Nauk SSSR, Doklady*, v. 124, no. 4, Feb. 1, 1959, p. 930-932.

7378* A Comparative Physiological Investigation of Two Strains of *Actinomyces violaceous* Producing Antiviral Antibiotics. (*In Russian.*) Sravnitel'noe fiziologicheskoe izuchenie dvukh shtammov *act. violaceus*, obrazuiushchikh antivirusnye antibiotiki. ***A. A. Mel'nikova and N. M. Veselov.*** *Antibiotiki*, v. 4, no. 1, Jan.-Feb. 1959, p. 31-36.

7379* The Effect of Antibiotics of the Tetracycline Series and of Their Combinations With Phage Upon Immunological Indices in Experiments. Demonstrates that the introduction to immunized rabbits of antibiotics of the tetracycline series and of phage did not prevent the formation and increase of the antibody titer, nor did it hinder the preventive properties of immune sera and the activation of the phagocytic reaction. (*In Russian.*) Vliianie antibiotikov tetratsiklinovogo riada i kombinatsii etikh preparatov s bakteriofagom na immunologicheskie pokazateli v eksperimente. ***O. I. Sheviakova and Iu. S. Kolesnikova.*** *Antibiotiki*, v. 4, no. 1, Jan.-Feb. 1959, p. 66-70.

7380* Human-Factors Requirements for Putting a Man in Orbit. Man's survival and operational capability in an artificial earth satellite depend primarily on the reliability and accuracy of the launching, guidance and recovery operations on the one hand, and on the perfection of his engineered environment, on the other. If a physiologically habitable environment is created, and if its functions during orbiting are secured, the human passenger can withstand the stresses involved in manned satellite operations of a limited duration. ***Siegfried J. Gerathewohl and George R. Steinkamp.*** *Astronautica Acta*, v. 5, no. 1, 1959, p. 73-81.

7381* Isolation of Antibodies by Means of Cellulose Fixed Antigens and Study of Their Properties. Cellulose fixed proteins, both antibodies and antigens, retain their immunological properties. Cellulose fixed protein antigens continue to react specifically with the respective antibodies. The antibodies to horse serum albumin, human serum albumin and egg albumin isolated from the rabbit serum retained their biological activity. They were completely precipitated upon addition of the respective antigens and proved homogeneous in electrophoretic and sedimentation analysis. (*In Russian.*) Vydelenie chistykh antitel pri pomoshchi fiksirovannykh na tselliuloze antigenov i izuchenie ikh svoistv. ***A. E. Gurvich, R. B. Kapner, and R. S. Nezlin.*** *Biokhimiia*, v. 24, no. 1, Jan.-Feb. 1959, p. 144-156.

7382* Observations on the Histoformative Capacities of Tumor Cells Dissociated by Digestion With Trypsin. Two spontaneous and three transplantable mouse mammary adenocarcinomas and two mouse vaginal epitheliomas were investigated. Mouse mammary adenocarcinoma cells readily formed aggregates in which histological differentiation occurred. The histological structure of the aggregates was basically similar to that of the original tumor tissue. The cells of mouse vaginal epitheliomas also showed some capacity for aggregation, but their histoformative tendencies were very weak. ***Krystyna Dabrowska-Piaskowska.*** *Experimental Cell Research*, v. 16, no. 2, Feb. 1959, p. 315-323.

7383* The Centromeric and Nucleolus-Associated Heterochromatin of *Rattus norvegicus*. The structural details of each chromosome of the male Wistar rat at spermatogonial prophase and pachytene were studied and depicted by drawings and the findings were correlated with the appearance of the chromosomes at spermatogonial metaphase. A heterochromatic region adjacent to each respective kinetochore was recognized on each of the 20 pairs of autosomes. The autosomes of the 2nd and the 7th pairs carry the nucleolus organizers at their distal subterminal regions. The portion adjacent to the nucleolus organizer is marked with hetero-

chromatin. Both the X and the Y appear to be almost entirely heterochromatic. ***S. Ohno, W. D. Kaplan, and R. Kinosita.*** *Experimental Cell Research*, v. 16, no. 2, Feb. 1959, p. 348-357.

7384 The Structure and Physical Chemistry of Nucleic Acids and Nucleoproteins. Contains abstracts of papers presented at an informal discussion sponsored by Colloid and Biophysics Committee of the Faraday Society held in September, 1958. Topics discussed included denaturation of DNA, methylated bases in nucleic acids, nucleotide sequences, possible template mechanism for the synthesis of RNA by DNA, structure of RNA, physical chemistry of synthetic polynucleotides, ribonucleoprotein, and deoxyribonucleoprotein. *Faraday Society, Transactions*, v. 55, Mar. 1959, p. 487-499.

7385* Double Infections of Single Cells With Echo 7 and Coxsackie A9 Viruses. Virus particles derived from single cells infected with two enteroviruses have been studied. Evidence was obtained to indicate that phenotypic, but not genotypic, mixing occurs between Coxsackie A9 (CA9) and ECHO 7 (E7) viruses. CA9 has a more rapid growth cycle than E7 in rhesus monkey kidney cell cultures, and a slower one in patas cultures. In rhesus, when E7 virus was added first, CA9 could be added up to 2 hours later, and still a significant number of cells yielded either CA9 or doubly neutralizable virus. The converse was observed in patas cells. ***Heihachi Itoh and Joseph L. Melnick.*** *Journal of Experimental Medicine*, v. 109, Apr. 1959, p. 393-406.

7386* X-Ray Effects on Single Nerve Fibers. Electrophysiological responses of median and lateral giant nerve fibers of the earthworm were recorded during exposure, ***in vitro***, to X-rays. In response to external stimulation, during X-irradiation, these nerve fibers showed initially an increase in conduction velocity, a rise in spike amplitude, a decrease in relative refractory period, and an increase in sensitivity. These responses represent an enhancement of activity, attributable to bombardment with X-rays, rarely found in other biological systems. They were followed by deterioration of activity and eventual block, representative of the lethal action of X-rays, commonly observed in other biological systems. ***C. S. Bachofer and M. E. Gautereaux.*** *Journal of General Physiology*, v. 42, no. 4, Mar. 20, 1959, p. 723-735.

7387* Phenotypic Expression of a Genetic Property Introduced by Deoxyribonucleate. Transforming DNA manifests a phenotypic alteration in transformed pneumococci which has at least two stages in the process of expression. The completion of the first stage occurs with a mean time of about 60 minutes, and a terminal step, that of the transition of phenotype, occurs in less than 3 minutes. ***Maurice S. Fox.*** *Journal of General Physiology*, v. 42, no. 4, Mar. 20, 1959, p. 737-748.

7388* The Similar Specificity of the Combining Sites of an Individual Antibody Molecule. Concludes that heteroligating antibody is absent. Results are discussed from the standpoint of the mechanism of antibody formation. ***Alfred Nisonoff, Marvin H. Winkler, and David Pressman.*** *Journal of Immunology*, v. 82, no. 3, Mar. 1959, p. 201-208.

7389* Enhancing Effect of Crystalline Phospholipid From Human Breast Tumor on Neoplasms in Animals. ***Anwar A. Hakim.*** *Lancet*, v. 1, Mar. 21, 1959, p. 611-612.

7390* Secondary Structure in Ribonucleic Acids. RNA is considered to have a secondary structure consisting of small helical regions that involve approximately half of its nucleotides. This accounts for the relatively contracted state of RNA in solution, its limited reactivity and the indications that RNA X-ray diffraction patterns exhibit helical characteristics. ***P. Doty, H. Boedtker, J. R. Fresco, R. Haselkorn, and M. Litt.*** *National Academy of Sciences, Proceedings*, v. 45, Apr. 1959, p. 482-499.

7391* The Difference Between Spontaneous and Base-Analogue Induced Mutations of Phage T_4. Study reveals two kinds of fundamentally different mutagenic effects: a mutagenic effect by which certain base analogues induce forward mutations and their reversions, and a mutagenic effect which is responsible for the formation and reverison of those mutants which cannot be induced to revert by these base analogues. ***Ernst Freese.*** *National Academy of Sciences, Proceedings*, v. 45, Apr. 1959, p. 622-633.

7392 Research in Radiology. Attempts to bridge the gap between experimental radiobiology and clinical radiotherapy and to explore the feasibility of biometrically designed controlled clinical trials in radiotherapy. The topics treated include: factors determining radiosensitivity in the cell, factors in the host and tumor bed, factors related to the agent and mode of treatment, possibilities of a national experiment to evaluate supervoltage therapy. ***Henry S. Kaplan, editor.*** *National Research Council, Committee on Nuclear Science, Nuclear Science Series Report No.* 22, 1958, 208 pp. (QC771 N21nr Contin.)

7393* Protection of the Irradiated Ground Squirrel by Cysteine. Intravenous injection of cysteine prior to irradiation significantly protects the nonhibernating ground squirrel from the lethal effects of X-rays. Such protection was not demonstrated when cysteine was administered to the hibernating ground squirrel after irradiation. ***Douglas E. Smith.*** *Radiation Research*, v. 10, no. 3, Mar. 1959, p. 335-338.

7394 Radioisotopes in Scientific Research. Proceedings of the First (UNESCO) International Conference. v. III. Research With Radioisotopes in Human and Animal Biology and Medicine. v. IV. Research and Radioisotopes in Plant Biology and Some General Problems. Contains proceedings of the International Conference held in Paris in September, 1957. Covers such fields as pharmacology, metabolism, blood and blood proteins, nucleic acids, clinical physiology, reproduction, translocation, and biosynthesis. ***R. C. Extermann, editor.*** 763 pp. and 690 pp. 1958. Pergamon Press, New York. (QC770 In7.9p)

7395 Physics of Nerve Processes. Since 1938 investigations have been made on single nerve fibers and similar material to determine the electrical properties of their surface membrane, which is the structure primarily concerned in excitatory phenomena including the propagation of the nerve impulse. In the resting state the fiber has the characteristics of a leaky capacitative cable. Across the surface of large invertebrate nerve fibers there is a capacity of about 1 $\mu F\ cm^{-2}$ in parallel with a resistance of $1000 \Omega\ cm^2$ or more. An essential feature of the nerve impulse is the action potential, a transient alteration of membrane potential, which has an amplitude of about 100 mv, lasts about 1 msec at a given position along the fiber, and propagates at a rate of about 20 m sec^{-1}. ***P. Fatt.*** Paper from "Reports on Progress in Physics", v. XXI, p. 112-143. 1958. The Physical Society, London. (QC3 P56r Vis.)

7396* The Leeuwenhoek Lecture. The Problem of Anabiosis or Latent Life: History and Current Concept. ***D. Keilin.*** *Royal Society, Proceedings*, v. 150, ser. B, Mar. 17, 1959, p. 149-191.

7397* Some Unusual Properties of the Nucleic Acid in Bacteriophages S13 and ϕX174. Phages ϕX174 (and S13), labeled with P^{32}, are inactivated by decay of their incorporated radioactive atoms with approximately 100% efficiency, even at −196 C (assuming the DNA content of ϕX174 to be as determined by Sinsheimer). The high sensitivity of P^{32} decay suggests an unusual structure and function of the DNA in these phages. One possibility is a single-stranded DNA. ***Irwin Tessman.*** *Virology*, v. 7, no. 3, Mar. 1959, p. 263-275.

See also: **7453** (biological waste oxidation).

CERAMICS AND CONCRETE

7398 Aging and the Double Hysteresis Loop of $Pb_{1-x}Ca_xTiO_3$ Ceramics. To discover the mechanism of the processes causing the peculiar hysteresis loops, the loops and the dielectric properties were examined under various conditions. Each small region in the specimen has an asymmetric hysteresis loop. The observed propeller-shaped hysteresis loop is the result of random superpositions of all these asymmetric hysteresis loops. ***E. Sawaguchi and M. L. Charters.*** *American Ceramic Society, Journal*, v. 42, Apr. 1959, p. 157-164.

7399 Directional Hardness of Strontium Titanate by Peripheral Grinding. The method used is that of peripheral (zonal) grinding on oriented thin single-crystal disks. A significant anisotropy, consistent with the *m*3*m* symmetry of

the crystal structure, was observed. Experimental data are presented in detail for the three principal zones. ***A. A. Giardini and M. A. Conrad.*** *American Ceramic Society, Journal,* v. 42, Apr. 1959, p. 165-168.

7400 Factors Affecting Sinterability of Oxide Powders: BeO and MgO. Data on the sintering of BeO and MgO were reviewed with reference to the diffusion sintering model devised by Kuczynski and Herring. Sintering rates for compacts of the dead-burned oxide powders were in agreement with the bulk diffusion model with grain-boundary sinks, but those of the active low-calcined powders were not. During isothermal sintering the low-calcined powders had very high initial shrinkages, after which the shrinkage rate was low, corresponding to a rate index of about 10. The initial high rate was ascribed to crystallization and coalescence of the material comprising individual particles. The activation energy associated with the sintering of active BeO was estimated as 249 kcal. per mole. ***John F. Quirk.*** *American Ceramic Society, Journal,* v. 42, Apr. 1959, p. 178-181.

7401 The Glassmelting Process. I. A Theory of the Nature of Silicate Melts and of Their Interaction With Silica. A new theory of the nature of silicate melts postulating a distribution of anionic structures is developed to account for the kinetics of the silicate melt-silica interaction. The theory is applied to published data on the kinetics of this reaction, and correlations are made with recent viscosity studies and with commercial glassmelting practice. ***Charles L. McKinnis and John W. Sutton.*** *American Ceramic Society, Journal,* v. 42, Apr. 1959, p. 194-199.

7402* High-Density Concrete Made With Hydrous-Iron Aggregates. Physical properties of a high-density concrete tested under standard conditions and after heating at temperatures of 85, 200, and 350 C. The concrete has a density of 218 lb. per cu. ft. and a fixed water content of about 4.3% at 85 C, which makes it a desirable material for biological shields around atomic power reactors. Computed values of attenuation lengths are included for fast neutrons and gamma radiation. ***Harold S. Davis and Orville E. Borge.*** *American Concrete Institute, Journal,* v. 30; *ACI Proceedings,* v. 55, no. 10, Apr. 1959, p. 1141-1147.

7403 Suitability of Lightweight Aggregate for Bituminous Plant Mix. Using a reasonably well-graded 0 to ⅝-in. lightweight aggregate, Hubbard-Field tests were performed at varying asphalt content. Hubbard-Field tests of over 3500 lb. and compressive strengths of over 350 psi were obtained using 11.0 to 11.5% 85-100 penetration asphalt. The second consideration was the effect of water on bituminous mixtures using this type of aggregate. Mixes showed an index of retained strength to be 89.1%. ***John C. Wycoff.*** *ASTM Bulletin, no.* 235, Jan. 1959, p. 33-36.

7404 The Chemistry and Physics of Clays and Other Ceramic Materials. ***Alfred B. Searle and Rex W. Grimshaw.*** 3rd Ed. 942 pp. 1959. Interscience Publishers, New York. (TP815 Se17c3)

7405 Water-Sorption Characteristics of Clay Minerals. Samples were tested in a modified Enslin apparatus, and sorption curves were plotted. The data show that montmorillonite adsorbs more water than kaolinite, illite, and chlorite. The chlorites and illites have similar water-sorption properties. Mixtures of clay minerals and mixtures of clay minerals and sand tend to have water-sorption properties proportional to the percentage of clay mineral present. ***W. Arthur White and Ernesto Pichler.*** *Illinois State Geological Survey, Circular* 266, 1959, 20 pp. (TN21 IL6.7c Vis.)

7406 Ceramics and Glass and Their Application in Modern Aeronautics. Development of silicates and their application in the field of aeronautics. Glass, ceramics, and oxy-ceramic materials are dealt with and the properties of these materials are discussed. ***L. Zagar.*** *North Atlantic Treaty Organization, AGARD Report No.* 179, Apr. 1958, 15 pp. (TL565 Ag11r Vis.)

7407 The Use of Air-Entraining Admixtures in Concrete in Large Dams in the United States. Air-entraining admixtures; workability, bleeding and segregation; strength; resistance to abrasion; resistance to freezing and thawing; permeability and pore pressure; optimum air content; control of air content; temperature rise; cement content and construction practices. ***William Lerch.*** *Portland Cement Association, Research Department Bulletin* 99, Dec. 1958, 12 pp. (TP883 P83b Vis.)

7408 Long-Time Study of Cement Performance in Concrete. XI. Report on the Condition of Three Test Pavements After 15 Years of Service. One pavement is in western New York in a region subject to severe natural weathering, one in central Missouri where exposure conditions are moderately severe, and one in western South Carolina where mild weather prevails. Twenty-seven cements, differing widely in their chemical and physical properties, were used in these pavements. The New York pavement exhibits surface scaling in varying amounts on almost all sections containing the non-air-entraining cements. All sections containing air-entraining cements are still completely free from surface scale. Under the conditions prevailing on these projects, variations in the chemical composition and fineness of the cement appear to be without significance insofar as resistance to freezing and thawing is concerned. ***Frank H. Jackson.*** *Portland Cement Association, Research Department Bulletin* 102, Nov. 1958, p. 1017-1032. (TP883 P83b Vis.)

7409 Refractories Bibliography 1947-1956. Compiled by the Joint Refractory Committee of the American Iron and Steel Institute of The Refractories Institute. 1822 pp. University of Oklahoma Press, Norman, Oklahoma. (Z7914.R3 Am35r.)

7410 Metal-Ceramic Laminates. Forsterite-stainless steel 430, molybdenum-alumina, and Kovar-alumina laminates were fabricated employing brazing techniques. Laminates of molybdenum and a 40% alumina-60% mullite ceramic were hot pressed. ***R. K. Francis, R. Brown, E. P. McNamara, and J. R. Tinklepaugh.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-600, Nov. 1958, 69 pp. (TL507 Un3.18w Vis.)

7411 Zirconia: Its Crystallographic Polymorphy and High Temperature Potentials. The nature of zirconia; chemistry and crystallography of zirconia binary systems; future potentials of zirconia compositions. ***Berthold C. Weber and Murray A. Schwartz.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-646, July 1958, 21 pp. (TL507 Un3.18w Vis.)

7412 The Effect of Temperature on the Neutron Attenuation of Magnetite Concrete. The neutron attenuation of magnetic concrete is measured after heating the concrete to 100, 200, and 300 C. The experimentally determined relaxation lengths are compared to the value calculated from the concrete composition. Transverse streaming effects and temperature distributions are reported. ***D. E. Wood.*** *U. S. Atomic Energy Commission, HW*-58497, Dec. 11, 1958, 28 pp. (UF767 Un3.1hw Contin.)

7413 US/UK Graphite Conference. Papers delivered at St. Giles Court, London, Dec. 16-18, 1957. Covers physical and chemical properties, stored energy determination, and radiation effects. *U. S. Atomic Energy Commission, TID*-7565(Pt. 1), Mar. 16, 1959, 156 pp. (UF767 Un3ti Contin.)

See also: **7467** (hardened Portland cement, errors from partial drying); **7656** (glass fiber coating reinforcement); **7671** (ceramic insulation coatings); **7930** (coral rock cement plant); **8380** (light scattering by optical glass).

CHEMICAL ENGINEERING

7414 Advances in Petroleum Chemistry and Refining. Presented as an annual collection of progress reports written by leading authorities on particular subjects in the following fields: economics and future trends, unit operations and design, refining processes, petrochemicals, and mechanical equipment. ***Kenneth A. Kobe and John J. McKetta, Jr., editors.*** v. II. 634 pp. 1959. Interscience Publishers, New York. (TP690.A1 Ad95 Vis.)

7415 Nonequilibrium Thermodynamics: A Survey. Review of the field of thermodynamics of irreversible processes. The essential steps in the use of this form of the thermodynamics are the calculation of the entropy production, the setting up of the linear phenomenological equations, and the processes, especially to the coupling phenomena which occur when two or more such processes take place in the same system. ***K. G. Denbigh.*** *A.I.Ch.E. Journal*, v. 5, no. 1, Mar. 1959, p. 20-25.

7416 Low-Temperature Vapor-Liquid Equilibria in Ternary and Quaternary Systems Containing Hydrogen, Nitrogen, Methane, and Ethane. Data are presented for three ternary systems and the quaternary at pressures of 500 and 1,000 lb./sq. abs. and at temperatures of −100 and −200 F. Charts are presented of equilibrium ratios as a function of temperature, pressure, and composition. ***Harry F. Cosway and Donald L. Katz.*** *A.I.Ch.E. Journal*, v. 5, no. 1, Mar. 1959, p. 46-50.

7417 Heat and Mass Transfer From Wall to Fluid in Packed Beds. Experiments were carried out separately. In heat transfer air was used as the fluid, and several kinds of solid particles with low and high thermal conductivities were investigated to determine effective thermal conductivities and wall heat transfer coefficients. In mass transfer the dissolution rate of the coated material on the inner wall of the packed tube to the water stream was measured, and wall mass transfer coefficients were analyzed. ***Sakae Yagi and Noriaki Wakao.*** *A.I.Ch.E. Journal*, v. 5, no. 1, Mar. 1959, p. 79-85.

7418 Formulas for Sizing Control Valves. Use of valve flow coefficient. *Air Conditioning, Heating, and Ventilating*, v. 56, Apr. 1959, p. 86.

7419* On the Existence of a Heterogeneous-Homogeneous Mechanism Under Conditions of Fluid Catalysis. The method of fluid catalysis was applied to elucidate the macromechanism of gas reactions under conditions approximating as far as possible those of ordinary industrial catalytic processes. Concludes that the investigated catalytic process in the fluidized layer is a complex heterogeneous-homogeneous reaction, the homogeneous stages occurring not only beyond the layer of fluid catalyst, but in the layer between the grains as well. Results cannot be explained on the basis of a purely heterogeneous theory of catalysis. (*In Ukrainian.*) Do pitannia pro naiavnist' geterogenno-gomogennogo mekhanizmu v umovakh fluidnogo katalizu. ***M. V. Polyakov, Z. Z. Vysotsky, V. V. Shalya, and P. P. Gushchin.*** *Akademiia Nauk Ukrains'koi RSR, Dopovidi*, 1959, no. 1, p. 67-71.

7420* The Influence of Acoustical Streaming on Convective Heat Exchange. Explanation of the causes of the intensification of the process of heat transfer by vibrations at natural convection in the experiments of Martinelli, Boetler, and Lemlich. Results of an experimental study of heat transfer. (*In Russian.*) Vliianie akusticheskikh techenii na protsess konvektivnogo teploobmena. ***P. N. Kubanskii.*** *Akusticheskii Zhurnal*, v. 5, no. 1, 1959, p. 51-57.

7421 Recent Advances in Cryogenic Engineering. A survey providing 56 references. ***Robert B. Jacobs.*** *ARS Journal*, v. 29, Apr. 1959, p. 245-251.

7422* Application of the "Gaseous" Fluorination in Uranium Tetrafluoride Production. Brief review of industrial and laboratory methods for obtaining UF_4 by treating UO_2 with gaseous HF at high temperature. (*In Russian.*) Primenenie "gazovogo" ftorirovaniia v proizvodstve tetraftorida urana. ***Iu. V. Gagarinskii.*** *Atomnaia Energiia*, v. 6, no. 2, Feb. 1959, p. 124-128.

7423* Mechanism of the Plutonium Nitrate Extraction by Mono- and Dibutyl Phosphates. Investigation of the extraction mechanism. Plutonium is extracted in the form PuK_4, where U is $[(C_4H_9)_2PO_4]^-$ or $[(C_4H_9H)PO_4]^-$. The equilibrium constant of the reaction with the monocompound = $(1.5 \pm 0.25) \cdot 10^3$, and with the bicompound = $(6.15 \pm 0.85) \cdot 10^3$. (*In Russian.*) K voprosu o mekhanizme ekstraktsii nitrata plutoniia mono- i dibutilfosfatami. ***V. B. Shevchenko and V. S. Smelov.*** *Atomnaia Energiia*, v. 6, no. 2, Feb. 1959, p. 140-144.

7424* The Chemical Behavior of Sodium- and Potassium-Pyro-Sulphates. The temperatures for formation and dissociation of the alkali-pyro-sulphates are given. The melting points of pure pyro-sulphates and their mixtures are determined and the occurrence of part-melting in some pyrosulphate mixtures is investigated as a function of the temperature. Finally, the behavior of pyro-sulphates in steam generators and gas turbines is discussed. (*In German.*) Das chemische Verhalten der Natrium- und Kaliumpyrosulfate. ***Kurt Wickert.*** *Brennstoff-Wärme-Kraft*, v. 11, Mar. 1959, p. 110-113.

7425* The Mean Temperature Difference in Hairpin Heat Exchangers. The counterflow heat exchanger is most favorable from the point of view of the heat transferred, but the hairpin heat exchanger is often preferred in practice for reasons of design. The quantity of heat transferred with counterflow heat exchangers is usually calculated with the mean logarithmic temperature difference. A different mean temperature is required for hairpin exchanges. (*In German.*) Die mittlere Temperaturdifferenz in Haarnadelwärmetauschern. ***H. Hausenblas.*** *Brennstoff-Wärme-Kraft*, v. 11, Mar. 1959, p. 114-116.

7426* Simultaneous Heat and Mass Transfer in Cooling Towers. II. Results obtained from the experimental work are analysed, the methods of analysis discussed and it is concluded that the Mickley method is the best available for analysis of the mass- and heat-transfer processes in a cooling tower. ***W. J. Thomas and P. Houston.*** *British Chemical Engineering*, v. 4, Apr. 1959, p. 217-222.

7427 A Rational Design Procedure for Pressure Vessels. Sets out the likely contingencies and the material properties involved in design. *British Welding Journal*, v. 6, Feb. 1959, p. 57-58.

7428* Some Aspects of the Chemistry of Water for Steam Power Stations. The testing of the water in a modern steam power station is nowadays a matter of microanalysis. Oxygen can now be determined to an accuracy of ±1 γ/litre. Examples show the importance of interpreting the determination of Cu which is an important factor when considering the aggressivity of the water. ***M. Bodmer.*** *Brown Boveri Review*, v. 45, nos. 11/12, Nov./Dec. 1958, p. 552-555.

7429 Tray Drying of Fine Powders. Drying rates of finely powdered Al soaps and diatomaceous silicas were determined in a tray dryer. The weight of solid on the tray was automatically recorded. As expected for fine powders, plots of drying rate against moisture content were concave downward. The data were correlated. ***J. A. Wheat and D. A. MacLeod.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 2, Apr. 1959, p. 47-54.

7430 The Pyrolysis of a Heavy Crude Oil in a Fluidized Bed. The pyrolysis of a heavy high S crude oil in an inert fluidized bed at temperatures between 550 and 800 C has resulted in the production of an olefin rich gas and a liquid product containing increasing amounts of aromatic material with increasing temperature. ***G. G. Madgwick, C. H. Amberg, and W. S. Peterson.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 2, Apr. 1959, p. 65-70.

7431* A Survey of Thermodynamic Parameters for Solvolysis in Water. A method is suggested for determining the standard state entropies (S°) of the transition state for the transition state for the neutral hydrolysis of esters in water. Characteristic linear correlations between the entropy and enthalpy of activation are observed for hydrolysis in water, as well as for the bimolecular halide exchange reaction in acetone and for acid-base equilibria. ***R. E. Robertson, R. L. Heppolette, and J. M. W. Scott.*** *Canadian Journal of Chemistry*, v. 37, Apr. 1959, p. 803-824.

7432* The Engineer and the Treatment of Residual Waters. A brief review of the problem stressing that the design of an important and efficient installation requires special knowledge and experience. (*In French.*) L'ingénieur et le traitement des eaux résiduaires. ***H. R. Oakley.*** *Centre Belge d'Etude et de Documentation des Eaux, Bulletin Mensuel No.* 98, Feb. 1959, p. 34-40.

7433 Plant Finds Cold Storage Is Safer Storage for Liquefied Gas. Converts ambient-temperature, high-pressure storage of liquefied gas to atmospheric-pressure storage below gas liquefaction temperature. *Chemical Engineering*, v. 66, Apr. 6, 1959, p. 76-78.

7434 Crystal Fractionation Beats Distillation. Uses continuous crystallization for winning commercial-grade naphthalene from sulfur-laden, crude tar distillate. *Chemical Engineering*, v. 66, Apr. 6, 1959, p. 80 + 1 page.

7435 The Chemical Route to—Peroxide. Autoxidation process flowsheet of Britain's Laporte Chemicals. ***C. S. Cronan.*** *Chemical Engineering*, v. 66, Apr. 6, 1959, p. 118-121.

7436 Find Mass Transfer Units. A new graphical method is utilized. ***Owen T. Hanna.*** *Chemical Engineering*, v. 66, Apr. 6, 1959, p. 127-130.

7437 Control Valve Construction. How process fluid properties, materials of construction, valve components, and reduced trim affect performance. ***Werner G. Holzbock.*** *Chemical Engineering*, v. 66, Apr. 6, 1959, p. 135-138.

7438 Physical Properties of Water. A chart which gives the properties pertinent to heat transfer design. ***Wallace R. Gambill.*** *Chemical Engineering*, v. 66, Apr. 6, 1959, p. 139-140.

7439 For Corrosives: Out-of-the-Ordinary Valves. Y and nonlubricated plug valves for erosive-corrosives. ***R. B. Wooster.*** *Chemical Engineering*, v. 66, Apr. 6, 1959, p. 162 + 2 pages.

7440 Measurement of Burning Rate of Gelatinised Petroleum. Description of an apparatus which provides a continuous measurement of the unconsumed weight of a burning petroleum material. ***K. Cree and R. F. Scrutton.*** *Chemistry & Industry*, 1959, no. 10, Mar. 7, p. 326-327.

7441* Centrifuging. New high-speed and low-speed centrifuges for industry; laboratory centrifuges; new centrifuge applications in the sugar, oils and fats, chemical, food, dairy and petroleum industries. ***E. Broadwell.*** *Chemical & Process Engineering*, v. 40, Mar. 1959, p. 86-90.

7442* Variable-Area Flow Meters. Explains how the variable-area meter works, the forms in which it is available, and the applications to which it can be put. ***R. Rutherford.*** *Chemical & Process Engineering*, v. 40, Mar. 1959, p. 94 + 2 pages.

7443* Heat Transfer to Internally Heated Beds of Glass Beads Fluidised With Air. A nomogram for solving McAdams equation. ***D. S. Davis.*** *Chemical & Process Engineering*, v. 40, Mar. 1959, p. 105.

7444 Purifies Uranium and Thorium by Pulse-Type Solvent Extraction. Brief description of a nuclear plant which can turn out nuclear fuels in various forms, shapes, and sizes—including cast metal and ceramic elements as well as chemical solutions. ***Ted F. Meinhold, E. R. Johnson, and C. W. Taylor.*** *Chemical Processing*, v. 22, Apr. 1959, p. 32-33.

7445 Translucent Plastic Tank Needs No External Glass Gage. Unit constructed of reinforced polyester resin, which holds 14,000 gal of 10% hydrochloric acid, is expected to give long service without maintenance. *Chemical Processing*, v. 22, Apr. 1959, p. 122 + 2 pages.

7446 Sifting Out Problem Petrochemicals. The Molex process using molecular-sieve treatments boosting gasoline ratings, may provide a new source of straight-chain heavy paraffins for chemical synthesis. *Chemical Week*, v. 84, no. 14, Apr. 4, 1959, p. 51 + 2 pages.

7447 Survey of Ethylene Chemicals' Upcoming Five Years of Plenty. Outlook for ethylene oxide and derivatives (ethylene glycol, ethanolamines, non-ionic surfactants, acrylonitrile, etc.); polyethylenes; ethanol; halogenated ethylenes (ethyl chloride, ethylene dichloride, ethylene dibromide); styrene; and related products. *Chemical Week*, v. 84, no. 17, Apr. 25, 1959, p. 36-52.

7448 Water Desalting Takes on a New Look. Water desalting demonstration plants will get record funds, new push from government's revamped Office of Saline Water. *Chemical Week*, v. 84, no. 17, Apr. 25, 1959, p. 55 + 2 pages.

7449* The Production of Fluorine Compounds and Its Perspectives in the "Chemical and Metallurgical Works". (*In Czech.*) Výroba fluorových sloučenin a její perspektiva ve spolku pro chemickou a hutní výrobu. ***Jaroslav Sucharda.*** *Chemické Listy*, v. 53, no. 3, Mar. 1959, p. 245-249.

7450* Model Investigations Into the Factors Affecting the Mixing of Gas and Air in Coke Oven Flues. The length of the heating flame in a coke oven flue is governed only by the mixing of the gas and the air, but the factors that govern such mixing are not clear. This model work is an attempt to establish these for the case of rich (coke oven) gas firing. It has been found that a wide range of flame lengths can be obtained for the same flow rates by employing burners and airports of different cross sectional area. A scale theory is put forward to render the model results applicable to actual systems. ***V. Jayaraman, C. Hulse, and M. W. Thring.*** *Combustion and Flame*, v. 3, no. 1, Mar. 1959, p. 97-104.

7451 Feed Water Degasifying. Additional degasifying in installations with ion-exchange water softening, general problems of water softening, and sensitivity of degasifiers to pressure changes. (*In German.*) *Speisewasserentgasung.* ***Boie.*** *Energietechnik*, v. 9, no. 2, Feb. 1959, p. 78 + 7 pages.

7452* Buildings for Chemical Plants. Description of several types of construction used in Canada to meet the various conditions imposed by their processes. Discussion of the characteristics and limitations of these constructions, and review of some of the forward thinking in this field. ***Robert N. Boyd.*** *Engineering Journal*, v. 42, Mar. 1959, p. 58-61.

7453* New Tool for Biological Oxidation of Wastes. Self-supporting pack eliminates tile underdrain; provides high ratio of surface area to volume, 94% void space. *Food Processing*, v. 20, Apr. 1959, p. 95-96.

7454* Role of Regulation in Developing Use and Transportation of Liquefied Methane. Successful transportation of liquefied methane could change world pattern of energy use. Cost estimates indicate that natural gas from abroad can compete with pipeline gas in coastal U. S. Need for a national policy with respect to import is indicated. ***William R. Connole.*** *Gas Age*, v. 123, Apr. 2, 1959, p. 32-35.

7455 Polyester Ducts Repel Sticky Pigments. Ducts developed are economical, easy to install, fire resistant, and easy to clean. ***Walter Peter.*** *Heating, Piping & Air Conditioning*, v. 31, Apr. 1959, p. 135.

7456 What to Consider When Selecting Globe and Gate Valves. Uses, sealing design, operating means, type of bonnet, and gearing. ***Carl A. Dopp.*** *Heating, Piping & Air Conditioning*, v. 31, Apr. 1959, p. 141-160.

7457 The Oxidation of Hydrocarbons. I. Considers the oxidation of hydrocarbons in solution, a subject of recent investigations; gas phase oxidation will follow. ***C. F. H. Tipper.*** *Industrial Chemist*, v. 35, Mar. 1959, p. 113-119.

7458 Current Trends in the American Coal Tar Industry. Discusses the production of special chemicals, tar from fluid carbonization plants, the hydrogenation of coal for chemicals, and the production of H from coke oven gas. ***A. Fowler Williams.*** *Industrial Chemist*, v. 35, Mar. 1959, p. 120-123.

7459 Latent Heat of Vaporisation of Coal Tar Fractions. A nomogram for solving the equation of the specific latent heat of vaporization at the atmospheric boiling point. ***P. Kharbanda.*** *Industrial Chemist*, v. 35, Mar. 1959, p. 124-125.

7460 Three Routes to Ethylene Glycol. Surveys market conditions and describes the direct oxidation process for the intermediate, ethylene oxide. ***P. W. Sherwood.*** *Industrial Chemist*, v. 35, Mar. 1959, p. 126-131.

7461 Developments in Wood Distillation. Refers to several wood distillation processes, including a 12,000-ton unit at Worksop, the Reichert vertical retort process, and the Lambiotte continuous process. ***M. Schofield.*** *Industrial Chemist*, v. 35, Mar. 1959, p. 134-136.

7462* The Diffusion of Gases Through Porous Media. The effect of the obstruction of solid on the permeability of porous media is examined. Concludes that, in Penman's equation for diffusion of gases through porous media, the constant 0.66 should be replaced by $\epsilon^{1/2}$ where ϵ is the porosity. ***T. J. Marshall.*** *Journal of Soil Sciences*, v. 10, no. 1, Mar. 1959, p. 79-82.

7463* Formulation of Aerosol Insecticides. Aerosol insecticides are primarily used to control houseflies and other flying insects encountered indoors and for this reason they almost always contain pyrethrum besides DDT or Lindane. This type of formulation is discussed, covering such practical considerations as choice of ingredients, propellants, and container components. ***Wm. Mitchell.*** *Manufacturing Chemist*, v. 30, Mar. 1959, p. 101-104.

7464* Amphoteric Surface Active Agents. These agents combine anionic and cationic chemical groups and properties. It is possible to make a great many amphoteric compounds, but the most useful are balanced amphoterics which are extremely versatile, showing particular advantages in cosmetics and pharmaceuticals and as metal cleaning detergents. ***D. Bass.*** *Manufacturing Chemist*, v. 30, Mar. 1959, p. 105-106.

7465* Manufacture of Fatty Acids by the Soda Saponification Process. Ricinoleic and 12-hydroxystearic acids, the main fatty acids of castor oil, contain between 60 and 65% free fatty acids when made by the conventional splitting process. In order to obtain products with at least 90% free fatty acids, the above process is used. ***A. Vickery.*** *Manufacturing Chemist*, v. 30, Mar. 1959, p. 107-108.

7466 Try Hard Rubber for Low Cost Parts. Properties and design recommendations for mechanical, electrical, and chemical uses. ***Thomas E. Wallis.*** *Materials in Design Engineering*, v. 49, Mar. 1959, p. 94-97.

7467 Errors Caused by Partial Drying of Hardened Portland Cement During Testing. Emphasizes the extreme magnitude of the change in strength which can be caused by partial drying of hydrated Portland cement, and directs attention to the great rapidity with which this change can occur. ***K. M. Alexander.*** *Nature*, v. 183, Mar. 28, 1959, p. 885-886.

7468 Molex—A Truly Continuous Process Using Molecular Sieves. A process providing the industry with a practical tool for the clean removal of normal paraffins from gasolines. ***D. B. Broughton and D. B. Carson.*** *Oil and Gas Journal*, v. 57, no. 15, Apr. 6, 1959, p. 112-115.

7469 Selective Finishing—Texaco Process Has Reached Commercial Stage. Texaco selective finishing uses molecular sieves to process a wide variety of stocks. Low octane number straight-chain components are removed and the remaining gasoline stream is significantly upgraded. ***W. F. Franz, E. R. Christensen, J. E. May, and H. V. Hess.*** *Oil and Gas Journal*, v. 57, no. 15, Apr. 6, 1959, p. 116 + 4 pages.

7470 New Petrochemical Intermediates . . . for Detergents. A new method has been developed for manufacture of higher-molecular-weight straight-chain alcohols. Pilot development is close to completion and present plans call for a commercial plant to be in operation by 1961. ***George E. Hinds.*** *Oil and Gas Journal*, v. 57, no. 16, Apr. 13, 1959, p. 96-97.

7471* Aspects of Refinery Corrosion Due to Crude. Considers which items in the running and maintenance of a refinery can be directly attributed to corrosion and its prevention. Causes contributing to the severity of corrosion are also considered, and means for its control are cited. *Petroleum*, v. 22, Apr. 1959, p. 141-143.

7472* Good Water Out of Sea Water. Evaporation equipment of Cleaver-Brooks Special Products. ***Fred Loebel.*** *Plant*, v. 19, Apr. 1959, p. 35-36.

7473 High Impact P.V.C. as a Pipe Material. III. Extrusion of Pipe, Moulding of Fittings and Design Considerations. Includes quality control. ***S. Mottram.*** *Plastics (London)*, v. 24, Mar. 1959, p. 98-99.

7474* Combustion and Bio-Oxidation Combined in Waste Plant at Chemstrand. Pensacola plant prevents pollution of Escambia River by new procedure for treating hard-to-handle nylon wastes. Stepped-up production rates required a whole new approach to wastes treatment. ***D. T. Lauria.*** *Power Engineering*, v. 63, Apr. 1959, p. 80-82.

7475* Isotherms for Preferential Adsorpton From Binary Liquid Mixtures, Based on Langmuir Equations. For the correlation of adsorption data from binary liquid mixtures Langmuir type isotherms based on volume fractions can be used. One must use the correct value of the volume of the adsorbed layer, and this is smaller than the volume of the pores in the absorbent particles. ***A. Klinkenberg.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, Jan. 1959, p. 83-90.

7476 Pressurized Packaging. A survey of the history and the various techniques used for making pressurized packs is based on some sections of the book, *Pressurized Packaging (Aerosols)*, by A. Herzka and J. Pickthall. ***A. Herzka.*** *Research*, v. 12, Mar. 1959, p. 97-102.

7477 Froth Flotation. Reviews froth flotation of man-made chemical compounds. ***P. F. Whelan.*** *Research*, v. 12, Apr. 1959, p. 133-140.

7478* Fundamental Hydraulic Principles of Trickling Filters. Experimental results show that liquid contact time on an inclined plane and on a sphere is inversely proportional to the 2/3 power of the liquid application rate. Contact time on a sphere is directly proportional to the 5/3 power of the radius of the sphere. Contact time of sewage flowing over an inclined plane is inversely proportional to the 1/3 power of the sine of the angle of inclination between the plane and the horizontal. The weight of slime on a trickling filter has no relationship to the contact time obtained between sewage and media. ***Don E. Bloodgood, G. H. Teletzke, and F. G. Pohland.*** *Sewage and Industrial Wastes*, v. 31, Mar. 1959, p. 243-253.

7479* A Contribution to the Increase of the Exactitude of Suction in Dust Measurements. A method of operation which increases the precision of suction and avoids the customary errors in these measurements. Explains the method by means of a rectangular measurement cross-section and applies the equation for setting the point of suction. (*In German.*) Ein Beitrag zur Hebung der Absaugegenauigkeit bei Flugstaubmessungen. ***Kurt Breitling.*** *Staub*, v. 19, Mar. 1959, p. 79-80.

7480* The Design Problems of the Combined Cationite Water Treatment Installations With Magnesia Desilicating. Considers the design of installations, storehouses, and various devices for the reagents. (*In Russian.*) Voprosy proektirovaniia kombinirovannykh kationitovykh vodopodgotovitel'nykh ustanovok s magnezial'nym obeskremnivaniem. ***A. A. Krupchitskii.*** *Teploenergetika*, v. 6, no. 3, Mar. 1959, p. 61-66.

7481 Recovery of Uranium Hexafluoride From Feed Plant Vent Gases. Pilot-plant studies of the use of a fluidized bed of UF_4 to scrub small amounts of UF_6 from feed plant vent gas streams are described. ***C. C. Littlefield, D. C. Brater, and J. H. Pashley.*** *U. S. Atomic Energy Commission*, K-1367, Mar. 12, 1959, 14 pp. (UF767 Un3.1k Contin.)

7482 A Process for Controlling Insoluble Uranium in Ore Concentrates. A process has been developed for converting nitric-acid-insoluble U in ore concentrates into soluble form. Ore concentrates are treated with a reducing agent such as CO or H at temperatures of 670-730 C. In the laboratory, retention times required to reach a given level of insoluble U vary inversely with the concentration of the reducing agent. ***G. P. Lang, E. N. Nelson, and C. W. Kuhlman.*** *U. S. Atomic Energy Commission*, MCW-1420, Feb. 2, 1959, 35 pp. (UF767 Un3.1mc Contin.)

7483 Operation of Experimental Plant for Producing Alumina From Anorthosite. Record of the operation of an experimental alumina plant by the Bureau of Mines at Laramie, Wyo. This experimental program was to appraise the technologic and economic feasibility of producing aluminum from nonbauxitic ores. ***Hillary W. St. Clair, et al.*** *U. S. Bureau of Mines, Bulletin* 577, 1959, 127 pp. (TN21 Un3b Vis.)

7484 Fischer-Tropsch Synthesis in a Fluidized-Catalyst Reactor With a Nitrided, Fused-Iron Catalyst. Description and results of the synthesis of liquid fuels from CO and H. ***J. J. Demeter and M. D. Schlesinger.*** *U. S. Bureau of Mines Report of Investigations* 5456, 1959, 16 pp. (TN21 Un3r Vis.)

7485 Preliminary Study of a Piston Pump for Cryogenic Fluids. The performance of a low-speed, five-cylinder piston pump designed for handling boiling hydrogen. ***Arnold E. Biermann and Robert C. Kohl.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 3-6-59E, Mar. 1959, 27 pp. (TL782 Un3rm Vis.)

7486* Sewage Plant Designed to Handle Industrial Wastes. An economical unit completed and put into operation in 1957 in the Borough of North East, Pa. ***Robert Dyment.*** *Water & Sewage Works*, v. 106, Apr. 1959, p. 164-168.

7487* Safety in Chlorine Handling. Fourth of a series of articles on chlorination practices is devoted to the emergency aspects of Cl use. ***Edmund J. Laubusch.*** *Water & Sewage Works*, v. 106, Apr. 1959, p. 169-175.

7488* Water Recirculation in Steelworks. Sets out the basic considerations governing the design of water recirculation systems to provide cooling facilities in steelworks and describes in detail the system brought into use in 1953 at the 11 in. continuous bar mill of the Park Gate Iron and Steel Company Ltd., at Rotherham. ***I. M. E. Aitken, E. L. Streatfield, and H. C. White.*** *Water and Water Engineering*, v. 63, Mar. 1959, p. 103-116.

7489* The Use of Low Density Polythene Tube in United Kingdom Water Supply. ***D. A. Gill.*** *Water and Water Engineering*, v. 63, Mar. 1959, p. 120-125.

7490* Know Your Mud Pump—It Can Save You Money. IX. Mud Pump Volumetric Efficiency. Increased mud pump volumetric efficiency will decrease drilling costs and improve drilling operations. ***Samuel L. Collier.*** *World Oil*, v. 148, Apr. 1959, p. 182 + 3 pages.

CHEMISTRY—ANALYTICAL

7491* Qualitative Chromatographic Method for Identifying Mildew Inhibitors on Military Fabrics. Qualitative method using paper chromatography which can be used to identify copper-8-quinolinolate, salicylanilide, 2,2'-methylene-bis-(4-chlorophenol), and zinc salts of dithiocarbamic acid. The method is rapid and requires no specialized laboratory equipment. ***Thomas D. Miles and Armando C. Delasanta.*** *American Dyestuff Reporter*, v. 48, no. 7, Apr. 6, 1959, p. 31-32.

7492* Identification of 2-Ethylhexyl Hydrogen Sebacate in Bis(2-ethylhexyl) Sebacate Synthetic Oils. The acid monoester 2-ethylhexyl hydrogen sebacate has been identified in bis(2-ethylhexyl) sebacate oils by carrying out a partial separation of components with the solvents Skellysolve C and acetonitrile-methanol and by examining the infrared spectrum of the fraction contained in the acetonitrile-methanol phase for the characteristic 1,710- and 1,740-cm.$^{-1}$ absorption peaks of the monoester. ***Edward B. Dismukes.*** *American Oil Chemists' Society, Journal*, v. 36, Apr. 1959, p. 154-155.

7493* Radiochemical Investigations on the Recovery for Analysis of Trace Elements in Organic and Biological Materials. ***T. T. Gorsuch.*** *Analyst*, v. 84, Mar. 1959, p. 135-173.

7494* The Determination of Lead Styphnate in Priming Compositions Used in Explosives. Extraction of the sample with a solution of ammonium acetate and measurement of the optical density of the resulting solution is described. ***H. C. J. Saint and J. Hewson.*** *Analyst*, v. 84, Mar. 1959, p. 183-187.

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7496 Portable Analyzer for Determination of Dissolved Oxygen in Water. Application of Rapid-Dropping Mercury Electrode. Unique feature is the use of a mercury drop time of about 0.25 second per drop, which produces a current relatively insensitive to agitation or to sample flow. ***Carl P. Tyler and J. H. Karchmer.*** *Analytical Chemistry*, v. 31, Apr. 1959, p. 499-502.

7497 Determination of Unsaturation Distribution in Polybutadienes by Infrared Spectrometry. ***Robert S. Silas, Joy Yates, and Vernon Thornton.*** *Analytical Chemistry*, v. 31, Apr. 1959, p. 529-532.

7498 Identification of Pigments in Paint Products by Infrared Spectroscopy. Qualitative identification of pigments in paint, products of unknown or questionable formulation. ***T. R. Harkins, J. T. Harris, and O. D. Shreve.*** *Analytical Chemistry*, v. 31, Apr. 1959, p. 541-545.

7499 Separation of Rare Earths From Beryllium, Magnesium, Zirconium, Titanium, Uranium, and Stainless Steel. ***M. W. Lerner and L. J. Pinto.*** *Analytical Chemistry*, v. 31, Apr. 1959, p. 549-551.

7500 Alkalimetric Determination of Sodium in Ball Propellants. ***George Norwitz.*** *Analytical Chemistry*, v. 31, Apr. 1959, p. 574-578.

7501 Titrimetric Determination of Nitrogen in Nitrocellulose and of Nitrocellulose in Double-Base Propellants. Modified ferrous-titanous titrimetric method for determining the % of nitrogen in nitrocellulose and of nitrocellulose in double-base propellants appears to be superior to previously available methods in a number of ways. ***Raymond H. Pierson and Elmo C. Julian.*** *Analytical Chemistry*, v. 31, Apr. 1959, p. 589-592.

7502* Methods for the Qualitative, Semiquantitative and Quantitative Determination of Iodoamino Acids and of Inorganic Iodide in Iodoprotein Digests and in Human Serum. ***Richard H. Mandl and Richard J. Block.*** *Archives of Biochemistry and Biophysics*, v. 81, no. 1, Mar. 1959, p. 25-35.

7503* Partition Chromatography and Its Use in the Plant Sciences. General considerations; methods and materials; apparatus; specific applications to plant materials. ***J. F. Thompson, et al.*** *Botanical Review*, v. 25, no. 1, Jan.-Mar. 1959, 263 pp.

7504* Quantitative Gas Chromatography of Reaction Products From the Catalytic Oxidation of Ethylene. Simple two-stage gas chromatograph is described which employs only one detector for both effluent streams. It was designed specifically for the routine quantitative analysis of mixtures of ethylene oxide, CO_2, and ethylene in the presence of water vapor and a large excess of air, and for concentrations down to 0.2% by volume of individual components. ***C. H. Amberg, E. Echigoya, and D. Kulawic.*** *Canadian Journal of Chemistry*, v. 37, Apr. 1959, p. 708-713.

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7506* Determination of Maleic Acid in Its Copolymers With Vinyl-Chloride and -Acetate. Quantitative determination of maleic acid present in terpolymers with vinyl chloride and vinyl acetate, as such or in the form of maleic anhydride or of aliphatic alcohol monoesters, carried out by volumetric titration. (*In Italian.*) Determinazione dell'acido maleico nei suoi copolimeri con cloruro di vinile e acetato di vinile. ***P. Maltese, T. Di Gioacchino, and E. Garzuglia.*** *Chimica e l'Industria*, v. 41, Mar. 1959, p. 218-221.

7507 Gas Chromatography 1958. Proceedings of the second symposium organized by the Gas Chromatography Discussion Group under the auspices of the Hydrocarbon Research Group of the Institute of Petroleum and the Koninklijke Nederlandse Chemische Vereniging held at the Royal Tropical Institute, Amsterdam, 19-23 May 1958. ***D. H. Desty, editor.*** 383 pp. 1958. Butterworths Scientific Publications, London. (QD271 D47g)

7508 The Determination of Trace Amounts of Cobalt in Iron and Steel and Some Associated Materials. Method is described for the determination of traces of Co ($< 0{\cdot}04\%$) in iron, steel, iron ore, Ni, and Cr metal, and the ferro-alloys of Mn, Ti, Nb, and Cr. The procedure depends on a photometric measurement of the Co complex with nitroso-R-salt after a zinc oxide separation and precipitation of the Co with α-nitroso β-naphthol together with Fe as "carrier". *Iron and Steel Institute, Journal*, v. 191, pt. 3, Mar. 1959, p. 236-240.

7509 Direct Colorimetric Analysis of Cholinesterase-Inhibiting Insecticides With Indophenyl Acetate. Anticholinesterase activity due to the hydrolysis of indophenyl acetate is measured colorimetrically in the presence of the following insecticide residues: Sevin, Thimet, Guthion, and Trithion. The variables affecting the reaction such as enzyme concentration, temperature, preincubation time, and pH have been studied. ***T. E. Archer and Gunter Zweig.*** *Journal of Agricultural and Food Chemistry*, v. 7, Mar. 1959, p. 178-181.

7510 Separation of Aliphatic Disulfides and Trisulfides by Gas-Liquid Partition Chromatography. Polar stationary phases, Carbowax and Reoplex, and a nonpolar phase, Apiezon M, have been compared. ***John F. Carson and Francis F. Wong.*** *Journal of Organic Chemistry*, v. 24, Feb. 1959, p. 175-179.

7511 Rapid Determination of Niobium in Stainless Steel. A spectrophotometric procedure is described whereby the Nb content of 18-8 type stainless steels can be determined in an hour and a half. Details are given of the method of separation of the Nb, and of the precautions to be taken in the presence of interfering elements. ***R. St. J. Emery.*** *Metallurgia*, v. 59, Feb. 1959, p. 101-103.

7512* Microtitration of Weak Organic Acids in Nonaqueous Solvents. Feasibility of applying nonaqueous techniques to the determination of weak organic acids on a micro scale; evaluation of various solvents; limiting factors in the titrimetric determination of weak organic acids with visual or potentiometric endpoints. ***R. K. Maurmeyer, Michel Margosis, and T. S. Ma.*** *Mikrochimica Acta*, 1959, no. 2, p. 177-191.

7513* Turbidimetric Determination of Traces of Phosphorus in Tungsten and Other Metals. A procedure is given for the turbidimetric determination of traces of P in W as 3-strychnine-12-phosphorus-12-molybdate. The interference of As in this method was studied. The procedure, among other things, was tested through determination of the change in the P-content during reduction by H_2 of the WO_3 prepared with H_3PO_4. As little as $5 \cdot 10^{-5}\%$ P could be measured in a 1-g sample. Directions are given for the determination of traces of phosphorus in Cu, Ag, Mg, Cr, Mo, Mn, Co, Ni, Al, Si, and Ge. (*In German.*) Die turbidimetrische Bestimmung von Phosphorspuren in Wolfram und in anderen Metallen. ***A. J. Hegedüs and M. Dvorszky.*** *Mikrochimica Acta*, 1959, no. 2, p. 202-209.

7514* The Titrimetric Micro Determination of Sulphate Using Lead Nitrate as Titrant and Dithizone as Indicator. ***D. C. White.*** *Mikrochimica Acta*, 1959, no. 2, p. 254-269.

7515* Microdetermination of Traces of Sodium, Potassium and Calcium in Tungsten Metal and Tungsten Oxides by Flame Photometry. The method described here permit the determination of 10^{-2} to $10^{-5}\%$ Na or 10^{-2} to $10^{-4}\%$ K and Ca in W metal and W oxides. The tungsten is driven off by means of CCl_4. The material of the boat, from which the sample is volatilized, and the volatilization temperature affect the analytical findings. Fundamentally, the method can be used for the determination of all alkali- and alkaline earth metals. (*In German.*) Die Mikrobestimmung von Natrium-, Kalium- und Calcium- spuren in Wolframmetall und Wolframoxyden mit dem Flammenphotometer. ***A. J. Hegedus, J. Neugebauer, and M. Dvorszky.*** *Mikrochimica Acta*, 1959, no. 2, p. 282-293.

7516* Spectrofluorimetry and Its Application to Chemical Analysis. A review describing the development of spectrofluorimetry, and the present state of the art. ***R. J. Bartholomew.*** *Reviews of Pure and Applied Chemistry*, v. 8, no. 4, Dec. 1958, p. 265-301.

7517* The Determination of Free Sulfur in Accelerators. Adsorption chromatography can be utilized to separate free S from the common accelerators containing chemically bound S after which the separated S can be estimated by a polarographic method. ***R. A. Hively and C. W. Wadelin.*** *Rubber Chemistry and Technology*, v. 32, no. 1, Jan.-Mar. 1959, p. 123-127.

7518* Quantitative Spectrographic Analysis of the Rare Earth Elements. X. Determination of Rare Earth Impurities Commonly Associated With Purified Thulium, Ytterbium, Lutetium and Scandium. ***R. N. Kniseley, V. A. Fassel, R. W. Tabeling, B. G. Hurd, and B. B. Quinney.*** *Spectrochimica Acta*, v. 13, no. 4, Jan. 1959, p. 300-303.

7519* The Use of Derivative Spectroscopy for Determining Methyl Groups in Polythene. Second derivative of the infra-red absorption spectrum of polythene in the region of 1378 cm^{-1} has been used for the estimation of the number of methyl groups per hundred C atoms in the range 2·0-0·05. ***G. L. Collier and A. C. M. Panting.*** *Spectrochimica Acta*, v. 14, Jan. 1959, p. 104-118.

7520* Structural Analysis of Hydrocarbon Molecules Based on Their Raman Spectrum. ***M. M. Sushinskiĭ.*** *Spectrochimica Acta*, v. 14, Jan. 1959, p. 271-283.

7521* The Spectrographic Analysis of Antimony and Antimony Sulphide for Heavy Metals. ***G. F. G. Knipe.*** *Spectrochimica Acta*, 1959, no. 1, Mar., p. 49-55.

7522* Determination of Trace Amounts of Cobalt in Steel by 2-Nitroso-1-naphthol. (*In Japanese.*) ***Kaoru Hosoda, et al.*** *Tetsu to Hagané (Journal of the Iron and Steel Institute of Japan)*, v. 45, no. 3, Mar. 1959, p. 295-297.

7523 The Determination of Uranium in Aluminum-Uranium Alloys: Application of Polarized Electrode Endpoint Indication. A rapid method with a coefficient of variation of 0.20%. ***W. J. Sewalk and G. W. Goward.*** *U. S. Atomic Energy Commission, WAPD-209*, Dec. 1958, 8 pp. (UF767 Un3.1wa Contin.)

7524 Spectrographic Analysis of Rare-Earth Elements. An emission spectrometric analytical method using d.c. carbon-arc excitation of various rare-earth-oxide mixtures. Lanthanum oxide serves the dual purpose of an internal standard and a constant major constituent. ***L. Allan White, Margaret Gerring, and Dorothy S. de la Haba.*** *U. S. Bureau of Mines Report of Investigations* 5454, 1959, 13 pp. (TN21 Un3r Vis.)

7525* Volumetric Determination of Iron (III) With Hydroxylamine as a Reducing Agent. ***G. Gopala Rao and G. Somideramma.*** *Zeitschrift für Analytische Chemie*, v. 165, no. 6, 1959, p. 432-436.

7526* Titrimetric Determination of Tungstate Ion as Lead Tungstate. A report on the conditions occurring in the precipitating titration of tungstate ion with a lead nitrate solution by means of a new end point recorder with adsorption mixing indicators. (*In German.*) Zur titrimetrischen Bestimmung des Wolframations als Bleiwolframat. ***H. Grubitsch, N. Özbil, and K. Kluge.*** *Zeitschrift für Analytische Chemie*, v. 166, no. 2, 1959, p. 114-120.

7527* A New Infra-Red Absorption Spectrum of Ice. A new IR spectrum of ice is reported, exhibiting sharp lines, as compared with most previous investigations. In addition to four clear OH-absorption bands, the partial band at 3247 cm^{-1} was divided into two components at 3245 and 3265 cm^{-1}. The causes of this spectrum were discussed. (*In German.*) Über ein neues Infrarot-Absorptionsspektrum des Eises. ***R. Mutter, R. Mecke, and W. Lüttke.*** *Zeitschrift für Physikalische Chemie (Frankfurt)*, v. 19, nos. 1/2, Jan. 1959, p. 83-88.

7528* On the Polarographic Determination of Indium. New method has been developed for separating interfering elements when In is determined polarographically in the concentrates and products of plant treatment. The method includes the following: indium sulfate solutions containing 20% of free H_2SO_4 are treated with zinc amalgam, an alkaline element chloride is added into the purified solution up to the concentration of 10% (wt.) and In is determined polarographically. (*In Russian.*) K voprosu o poliarograficheskom metode oprede-

leniia indiia. ***A. T. Nizhnik and I. S. Chaus.*** *Zhurnal Analiticheskoĭ Khimii,* v. 14, no. 1, Jan.-Feb. 1959, p. 37-40.

7529* Spectro-Chemical Determination of Magnesium and the Influence of the Magnesium Content on the Analysis of Silicon and Manganese in Cast Iron. Method permits the determination of 0.005% and more of Mg. (*In Russian.*) Spektrokhimicheskoe opredelenie magniia i vliianie ego soderzhaniia na rezul'taty analiza kremniia i margantsa v chugunakh. ***A. S. Dem'ianchuk and E. D. Kukharenko.*** *Zhurnal Analiticheskoĭ Khimii,* v. 14, no. 1, Jan.-Feb. 1959, p. 45-49.

7530* Quantitative Determination of the Three Nitrochlorobenzene Isomers When Present Together by Means of Infra-Red Absorption Spectra. A method has been developed for quantitatively determining *m*- and *p*-isomers in industrial nitrochlorobenzene. The lowest content determined is about 0.5%. (*In Russian.*) Kolichestvennoe opredelenie trekh izomerov nitrokhlorbenzola v ikh smesi pri pomoshchi infrakrasnykh spektrov pogloshcheniia. ***V. A. Pozdyshev and E. S. Levin.*** *Zhurnal Analiticheskoĭ Khimii,* v. 14, no. 1, Jan.-Feb. 1959, p. 128-132.

See also: **8003** (coulometric titrator); **8018** (gas chromatograph).

CHEMISTRY—INORGANIC AND GENERAL

7531* Study of Systems With Concentrated Hydrogen Peroxide. XX. Synthesis of Zinc Peroxides From the Solutions of Zinc Salts and Physico-Chemical Characteristic of $ZnO_2 \cdot H_2O$. The zinc peroxides obtained were $ZnO_2 \cdot H_2O$ and $ZnO_2 \cdot 0.5H_2O$. Dehydration of $ZnO_2 \cdot H_2O$ by means of absolute alcohol and ester causes the formation of $ZnO_2 \cdot 0.5H_2O$. The hydrogen peroxide structure of the zinc peroxides was described on the basis of their properties. (*In Russian.*) Izuchenie sistem s kontsentrirovannoĭ perekis'iu vodoroda. XX. Sintez perekisnykh soedineniĭ tsinka iz rastvorov soleĭ tsinka i fiziko–khimicheskaia kharakteristika $ZnO_2 \cdot H_2O$. ***L. V. Ladeinova.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk,* 1959, no. 2, Feb., p. 195-201.

7532 Infrared Studies of the Bromine Fluorides. ***Lawrence Stein.*** *American Chemical Society, Journal,* v. 81, Mar. 20, 1959, p. 1273-1276.

7533 Ozone Fluoride of Trioxygen Difluoride, O_3F_2. The existence of ozone fluoride, O_3F_2, has been put on a solid foundation by isolating the pure compound and analyzing it. O_3F_2 is a deep blood-red liquid, solidifying at 83 K and decomposing at about 116 or higher in a clean cut reaction to O_2 and O_2F_2. ***A. D. Kirshenbaum and A. V. Grosse.*** *American Chemical Society, Journal,* v. 81, Mar. 20, 1959, p. 1277-1279.

7534 Nitrogenous Chelate Complexes of Transition Metals. I. The Constitution and Properties of the 1: 10-Phenanthroline Complexes of Tervalent Gold. ***C. M. Harris.*** *Chemical Society, Journal,* 1959, Feb., p. 682-687.

7535 The Interaction of Hexamethyldisiloxane With Aluminium Halides and With Iodine. ***Alan H. Cowley, Fred Fairbrother, and Norman Scott.*** *Chemical Society, Journal,* 1959, Feb., p. 717-722.

7536 The Composition of the "Strong" Phosphoric Acids. Study of the composition of phosphoric acids between the range 67.4-89.4% of phosphoric oxide has largely confirmed Parks and Van Wazer's reorganization theory. ***R. F. Jameson.*** *Chemical Society, Journal,* 1959, Feb., p. 752-759.

7537 An Investigation of the "Ziegler" Catalysts Obtained by Treating Titanium Tetrachloride With Aluminium Alkyls. Catalytic materials were isolated and analyzed, attention being concentrated on the dark solids formed on mixing the reactants. ***M. L. Cooper and J. B. Rose.*** *Chemical Society, Journal,* 1959, Feb., p. 795-802.

7538 The Reaction Between Ammonia and Transition-Metal Halides. V. The Reaction of Ammonia With Titanium(IV) Bromide and Titanium(IV) Iodide. ***G. W. A. Fowles and D. Nicholls.*** *Chemical Society, Journal,* 1959, Mar., p. 990-997.

7539 Mixed Halides of Phosphorus(V). II. Dichlorotrifluorophosphorane. Vapor pressure, melting point, infrared spectra, and conductance in aceto-nitrile are reported for PF_2Cl_3. ***T. Kennedy and D. S. Payne.*** *Chemical Society, Journal,* 1959, Mar., p. 1228-1232.

7540 Phosphonitrilic Halides. Brief survey given and some recent developments highlighted. ***R. A. Shaw.*** *Chemistry & Industry,* 1959, no. 13, Mar. 28, p. 412-416.

7541 Formation of Ozone From Atomic Oxygen at Low Temperatures. ***R. A. Ruehrwein and J. S. Hashman.*** *Journal of Chemical Physics,* v. 30, Mar. 1959, p. 823-826.

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7620 The Solubility Behaviour of Aromatic Hydrocarbons in Benzene. Solubilities were determined between room temperature and approximately 80 C for diphenyl, *o*-, *m*-, and *p*-terphenyl, 1,3,5-triphenylbenzene, naphthalene, anthracene, phenanthrene, pyrene, triphenylene, chrysene, fluoranthene, fluorene, and acenaphthene. ***E. McLaughlin and H. A. Zainal.*** *Chemical Society, Journal,* 1959, Mar., p. 863-867.

7621 Kinetics of the Bromination of *m*-Nitrophenol in Aqueous Solution. Velocity constants are derived for the reactions of bromine with the *m*-nitrophenol molecule and anion, and for the reaction of the tribromide ion with the *m*-nitrophenol anion. ***R. P. Bell and T. Spencer.*** *Chemical Society, Journal,* 1959, Mar., p. 1156-1159.

7622 Infrared Spectra of Natural Products. VIII. The Characterization of Carbonyl Groups and Ethylenic Double Bonds in Tetracyclic Triterpenoids. IX. Frequencies and Intensities of Hydroxyl Absorption Bands in Triterpenoids and Similar Compounds. X. Conformations and Infrared Spectra of Substituted *cyclo*Hexanols. XI. Intramolecular Hydrogen-Bonding and Stereochemistry of Triterpenoid Diols and Related Compounds. VIII. ***A. R. H. Cole and R. L. S. Willix.*** IX. ***A. R. H. Cole, G. T. A. Müller, D. W. Thornton, and R. L. S. Willix.*** X. ***A. R. H. Cole, P. R. Jefferies, and G. T. A. Müller.*** XI. ***A. R. H. Cole and G. T. A. Müller.*** *Chemical Society, Journal,* 1959, Mar., p. 1212-1228.

7623* The Reactions of Electronically Excited Molecules in Solution. Processes involved in the formation and decay of electronically excited molecules; quenching processes which lead to chemical reaction in solution. ***J. P. Simons.*** *Chemical Society, Quarterly Reviews,* v. 13, no. 1, 1959, p. 3-29.

7624* Current Concepts in the Theory of Foaming. ***J. A. Kitchener and C. F. Cooper.*** *Chemical Society, Quarterly Reviews,* v. 13, no. 1, 1959, p. 71-97 + 2 plates.

7625* The Ternary System Cyclopentanone-Water-Succinic Acid. Preliminary examination of the binary systems water-cyclopentanone and succinic acid-cyclopentanone, and after the completion of the system succinic acid-water, the ternary system cyclopentanone-water-succinic acid was investigated at temperatures between −10 and 75 C. Solubility of succinic acid in the water-cyclopentanone mixtures varies, at constant temperature, as a function of the composition of the solvent mixture, showing a maximum for mixtures richer in water the higher the temperature considered. (*In Italian.*) Sul sistema ternario ciclopentanone-acqua-acido succinico. ***Vincenzo Bertini and Piero Pino.*** *Chimica e l'Industria,* v. 41, Mar. 1959, p. 195-201.

7626* Solubility of Electrolytes. II. The Ternary System Sodium Nitrite-Sodium Chloride-Water. Solubilities were determined by the synthetic polythermal method in the range of temperatures 18-47 C and the results were correlated by previously derived equations. ***E. Erdös and H. Šimková.*** *Collection of Czechoslovak Chemical Communications,* v. 24, no. 2, Feb. 1959, p. 503-507.

7627* Certain Physico-Chemical Properties of 3,4-Dimethylphenol. II. Solubility and Diffusivity in Water. Dependence of the diffusion coefficient of 3,4-dimethylphenol on temperature and concentration in water was measured; the results are expressed by equations with an average deviation of 0.2% for the temperature interval 20-50 C and for concentrations up to 5 g/l. ***J. Nývlt and E. Erdös.*** *Collection of Czechoslovak Chemical Communications,* v. 24, no. 2, Feb. 1959, p. 508-515.

7628* Catalysed Solvolysis of Benzyl Chloride. Kinetics of the solvolysis of benzyl chloride in aqueous ethanol, under catalysis by mercuric chloride. ***K. Saramma and R. Anantaraman.*** *Indian Academy of Sciences, Proceedings,* v. 49, sec. A, no. 2, Feb. 1959, p. 111-116.

7629 Diffusion in Ethylene Polymers. IV. Self-diffusion coefficients for two low molecular weight fractions of a linear polyethylene. ***David W. McCall, Dean C. Douglass, and Ernest W. Anderson.*** *Journal of Chemical Physics,* v. 30, Mar. 1959, p. 771-773.

7630 Solvent Effects in the Reaction of Free Radicals and Atoms. V. Effects of Solvents on the Reactivity of *t*-Butoxy Radicals. Quantitative data in regard to the peroxide-catalyzed reaction of chloromethanes with cyclohexane are presented. ***Glen A. Russell.*** *Journal of Organic Chemistry,* v. 24, Mar. 1959, p. 300-302.

7631 Catalytic Activation of Molecular Hydrogen by Cobalt Cyanide Solutions. Study of the reduction, D_2-H_2O exchange, paramagnetic properties and ultraviolet absorption of aqueous potassium cobaltous(II) cyanide solutions. ***G. A. Mills, S. Weller, and A. Wheeler.*** *Journal of Physical Chemistry,* v. 63, Mar. 1959, p. 403-410.

7632* Thermal Decomposition of Poly(vinyl Chloride). Results of an investigation of the vacuum decomposition. Volatile products were studied after pyrolysis at temperatures up to approximately 400 C and the rates of decomposition, over a temperature range of 235 to 260 C. ***Robert R. Stromberg, Sidney Straus, and Bernard G. Achhammer.*** *Journal of Polymer Science,* v. 35, Mar. 1959, p. 355-368.

7633* Ultrasonic Velocity and Adiabatic Compressibility in Polyelectrolyte Solutions. ***Junkichi Sohma.*** *Journal of Polymer Science,* v. 35, Mar. 1959, p. 429-440.

7634* Influence of the Velocity Gradient on the Viscosity of Polystyrene Solutions. Flow behavior of several polystyrene samples ranging in molecular weight between 1×10^5 and 2×10^6 in several solvents. ***G. M. Guzmán and J. M. G. Fatou.*** *Journal of Polymer Science,* v. 35, Mar. 1959, p. 441-463.

7635* The Relation Between the Structure of Emulsifiers of the Type Alkylaromatic Sulfoacids and the Process of Polymerization of Unsaturated Compounds. V. The Colloid-Chemical Properties of the Sodium Salts of Alkylarylsulfoacids. (*In Russian.*) Zavisimost' mezhdu stroeniem emul'gatorov tipa alkilaromaticheskikh sul'fokislot i protsessom polimerizatsii nepredel'nykh soedinenii. V. Kolloidno-khimicheskie svoĭstva natrievykh soleĭ alkilarilsul'fokislot. ***M. G. Zimina and N. P. Apukhtina.*** *Kolloidnyĭ Zhurnal,* v. 21, no. 1, Jan.-Feb. 1959, p. 50-57.

7636* Kinetics of the Formation of Crystallization Centers for Supercooled Organic Liquids on Impurity Particles. (*In Russian.*) Kinetika obrazovaniia tsentrov kristallizatsii pereokhlazhdennykh organicheskikh zhidkosteĭ na chastitsakh primeseĭ ***G. L. Mikhnevich.*** *Kolloidnyĭ Zhurnal,* v. 21, no. 1, Jan.-Feb. 1959, p. 69-79.

7637* The Molecular Constants of Polycarbonates in Solution. Measurements of sedimentation and diffusion constants, intrinsic viscosity, osmotic pressure and light scattering, performed on fractions of polycarbonates. From this a calibrating curve for viscometric molecular weight determinations is established. (*In German.*) Die molekularen Konstanten von Polycarbonaten in Lösung. ***G. V. Schulz and A. Horbach.*** *Makromolekulare Chemie,* v. 29, nos. 1-2, Jan. 1959, p. 93-116.

7638* Thermodynamic Properties of Gas Hydrates. II. Phase Equilibria in the System H_2S-C_3H_8-H_2O At −3°C. ***J. C. Platteeuw and J. H. Van Der Waals.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 78, Feb. 1959, p. 126-133.

7639 The Wavelength- and Temperature-Dependence of the Fluorescence Efficiency and of the Primary Photochemical Yield in Hexafluoroacetone Vapour. ***G. Giacometti, H. Okabe, and E. W. R. Steacie.*** *Royal Society, Proceedings,* v. 250, ser. A, Mar. 24, 1959, p. 287-300.

7640 Structure and Stability of Inorganic Azides. II. Some Physical and Optical Properties, and the Fast Decomposition of Solid Monovalent Inorganic Azides. ***B. L. Evans and A. D. Yoffe.*** *Royal Society, Proceedings,* v. 250, ser. A, Mar. 24, 1959, p. 346-366 + 2 plates.

7641* Ultra-Violet Spectra and Ionization Potentials of Hydrocarbon Molecules. Tables of i.p.s. are given which when supplemented by values available from spectroscopic determinations form a set of precise data from which structural correlations can be established. ***W. C. Price, R. Bralsford, P. V. Harris, and R. G. Ridley.*** *Spectrochimica Acta,* v. 14, Jan. 1959, p. 45-55.

7642* The Ultra-Violet and Infra-Red Absorption Spectra of the Methylbiphenyls: A Preliminary Analysis. ***G. H. Beaven and E. A. Johnson.*** *Spectrochimica Acta,* v. 14, Jan. 1959, p. 67-81.

7643* Infra-Red Absorption Spectra Study of H-Bonding and of Metal-Element Bonding. ***D. N. Shigorin.*** *Spectrochimica Acta,* v. 14, Jan. 1959, p. 198-212.

7644* The Infra-Red Absorption Spectra of Some α-Phenylhydrazono-Ketones and Alcohols. Compounds obtained by reaction of benzenediazonium salts with ketones containing an activated methylene group have been examined from 4000 to

650 cm^{-1}. ***E. M. Tanner.*** *Spectrochimica Acta*, 1959, no. 1, Mar., p. 20-26.

7645* Fluorescence of Some Metal Chelate Compounds of 8-Quinolinol. I. Effect of Metallic Ion and Solvent on Spectrum and Quantum Yield. ***W. E. Ohnesorge and L. B. Rogers.*** *Spectrochimica Acta*, 1959, no. 1, Mar., p. 27-40.

7646 Solubility of Lithium Hydroxide in Water and Vapor Pressure of Solutions of Lithium Hydroxide Above 220 F. ***Elmer F. Stephan and Paul D. Miller.*** *U. S. Atomic Energy Commission, BMI-1329*, Mar. 19, 1959, 19 pp. (UF767 U3b Contin.)

7647 Chemical Processes as Methods of Achieving High Temperatures. Study has shown that the most critical quantity limiting high temperatures in flames is the bond energy. A survey of diatomic species indicates that the N-N bond and the C-O bond are the two most energetic bonds known. ***David Altman.*** *U. S. Office of Technical Services, PB* 131549, June 25, 1956, 19 pp. (T21 Un3r Contin.)

7648* Infrared Spectra of Cobalt(III)-Complexes Containing Ammonia and Ions of Oxygen Acids as Ligands. The IR spectra are reported for the NaCl region. The nature of the metal-ligand bond is discussed comparing the spectra of the acid ligands with those of the free ions and the esters. (*In German.*) Ultrarotspektren von Kobalt(III)-Komplexen mit Ammoniak und Resten von Sauerstoffsäuren als Liganden. ***Hans Siebert.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 298, nos. 1-2, Jan. 1959, p. 51-63.

7649* Spectroscopic Investigation of Silicon Compounds. V. The Vibration Spectrum of Trisilylamine. The infrared and Raman-Spectra of $(H_3Si)_3N$ are reported and the frequencies are assigned as far as possible. (*In German.*) Spektroskopische Untersuchungen an Siliciumverbindungen. V. Das Schwingungsspektrum des Trisilylamine. ***Heinrich Kriegsmann and Walter Förster.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 298, nos. 3-4, Jan. 1959, p. 212-222.

COATINGS

7650 Coatings for Protecting Molybdenum From Oxidation at Elevated Temperature. Review of the available information on the more promising coating systems and methods. Data regarding the protective qualities of the coatings, and a number of illustrative examples of how some of these coatings have been applied to functional parts of Mo. ***E. S. Bartlett, H. R. Ogden, and R. I. Jaffee.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 109, Mar. 6, 1959, 40 pp. (TN799.T5 B32.7t Vis.)

7651 Dilatometric Study of Physical Chemistry of Sulfidizing Process. Dilatometric curves recorded for Fe powder specimens containing up to 4% S and, in part, 1% graphite, and heated to, and cooled from, 1000 C. Dilatometric curves obtained of similar specimens when heated once or twice to (and cooled from) 300 C. Formation of iron sulfides. Recommended sulfidizing temperature for anti-seizing properties. ***T. P. Gil'man.*** *Henry Brutcher Translation No.* 4393, 6 pp. (From *Metallovedenie i Obrabotka Metallov*, 1958, no. 10, Oct., p. 33-36.) Henry Brutcher, Altadena, Calif.

7652* Tungsten Carbide Hard-Facing. Method for depositing 100% WC into the surface of AISI 4142 alloy steel. *Carbide Engineering*, v. 11, Apr. 1959, p. 32-33.

7653 Oil Refinery Applications of Thick-Film Synthetic Coatings. Hot spray vinyl, catalyst-cured epoxy, catalyst-cured phenolic, catalyst-cured epoxy-modified phenolic and high-film-build alkyd coatings are discussed. Coating problems involved in protecting oil refinery equipment are noted. Tabular field data are included. ***R. W. Maier, W. B. Cook, and R. B. MacQueen.*** *Corrosion*, v. 15, Apr. 1959, p. 21-28.

7654 Evaluation of Steam Resistant Coatings for Carbon Steel Hospital Ware. Tests were made to determine the feasibility of replacing stainless steel hospital ware with coated carbon steel ware. More than 120 commercial coatings representing about 25 different chemical types over a variety of surface treatments were tried. It was found that coated mild steel could not be regarded as an adequate substitute though, a number of coating types, properly applied, could withstand 500 hours or more exposure to 250 F steam. ***E. G. Bobalek, W. R. R. Park, E. G. Bell, and W. R. Dawson.*** *Corrosion*, v. 15, Apr. 1959, p. 52-56.

7655 New Formulations Give Versatility to Urethane Coatings. Case histories are given of several coating applications using new formulations. ***Barnard Goodman.*** *Corrosion*, v. 15, Apr. 1959, p. 100.

7656 Glass Fiber Reinforcement for Coatings. Resistance of glass fiber to impact, atmospheric conditions and chemical attack is given with data presented in tables to show the properties and cost factors of basic fiber types, mats and cloths. Possible future applications of other fiber types are discussed briefly. ***B. A. Graham.*** *Corrosion*, v. 15, Apr. 1959, p. 102 + 1 page.

7657* Spray Painting Methods. Normal, hot, airless, and automatic spraying. *Corrosion Prevention and Control*, v. 6, Mar. 1959, p. 45-48.

7658 Porcelain Enamel. Specialized coatings solve critical finishing problems. *Design News*, v. 14, Mar. 30, 1959, p. 12-13.

7659 Applications and Problems of Metal Spraying. A review of the process in the Union of South Africa. ***J. F. Attwell.*** *Electroplating and Metal Finishing*, v. 12, Apr. 1959, p. 138-140.

7660 Flame-Priming Improves Metal Painting. A process offering the mining industry a simple, fast, low-cost way of properly preparing a metal surface for painting. ***G. H. Morgan.*** *Engineering and Mining Journal*, v. 160, Apr. 1959, p. 86 + 1 page.

7661 FATIPEC, 1957. The Chemistry and Technology of Selected Modern Synthetic Resins for Surface Coatings. Papers submitted to the plenary session and to the sessions on polyester, epoxy, and polymerization resins of the fourth conference of the FATIPEC in Lucerne, Switzerland, on September 23-27, 1957. (*In German, French, and English.*) 294 pp. 1957, Verlag P. G. Keller, Winterthur, Switzerland. (TP978 F31c Over.)

7662* Understanding Flexographic Inks. Some Specific Applications Plus How to Diagnose Flexo Printing Problems. III. Discussion of art work, its layout and color selection problems; customer's specifications and end use requirements; ink cost factors; printing stock; and how to diagnose flexo printing problems. ***Jean M. Fisher.*** *Flexography*, v. 4, no. 4, Apr. 1959, p. 24 + 5 pages.

7663 Finishing Dental and Medical Apparatus. Description of two basic procedures used by the industry. ***Stanley H. Urlage.*** *Industrial Finishing*, v. 35, no. 6, Apr. 1959, p. 22 + 4 pages.

7664 Oil Finishes for Wood. Results of experiments with various materials. There is no substitute for linseed oil. ***Irving Strasnick.*** *Industrial Finishing*, v. 35, no. 6, Apr. 1959, p. 48 + 2 pages.

7665 Butyrate Topcoat Lacquer Used in Furniture Plant. Results obtained with butyrate lacquer. *Industrial Finishing*, v. 35, no. 6, Apr. 1959, p. 64 + 4 pages.

7666 Application of New Metal Coating Which Withstands 2000° F. A new protective resin-ceramic coating PT-404 developed to satisfy the needs of the missile industry. ***James F. Rice.*** *Industrial Heating*, v. 26, Mar. 1959, p. 554 + 4 pages.

7667* 4 Techniques for Resistance Welding Vinyl Coated Steel Sheet. Welding time, energy and pressure must be controlled to make a weld without damaging the vinyl. Current flow must be controlled from the backside because vinyl is an insulator. *Industry & Welding*, v. 32, Apr. 1958, p. 66.

7668 Mechanized Hot-Dip Galvanizing Offers Major Savings. A new machine controls the entire cycle to produce quality work in record amounts and at low cost. *Iron Age*, v. 183, no. 15, Apr. 9, 1959, p. 106-108.

7669 The Impregnation of Timber by Water-Borne Preservatives. I. General Survey. A Cu-Cr-As water-borne preservative impregnated into Douglas Fir timber is located within the cell wall of the wood cells. A submicroscopic deposit of random groups of crystals (presumably basic salts) is distributed irregularly throughout the wall, while a proportion at least of the metallic components complexes with the cellulose on the surface of the microfibrils. ***D. S. Belford, R. D. Preston, C. D. Cook, and E. H. Nevard.*** *Journal of Applied Chemistry*, v. 9, pt. 3, Mar. 1959, p. 192-200.

7670 Organic Coatings for Metal Products. A guide to the 15 major types of synthetic coatings—types, properties, and uses. ***Robert J. Fabian.*** *Materials in Design Engineering*, v. 49, Mar. 1959, p. 113-128.

7671 Ceramic Coatings for Insulation. Two types of coatings to withstand 3000 F and above have been developed. One type is a flame-sprayed ceramic oxide; the other is a metal-reinforced ceramic which is applied by troweling a ramming mix into a metallic matrix attached to the structural base metal. ***Alan V. Levy.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 86-89.

7672 Coating for Re-Entry. Alternate layers of Mo and alumina provide excellent protection from rocket blasts at 4500 F. By varying thickness and constitution of the layers, many combinations, each with unique properties for a specific application, can be devised. ***W. L. Aves.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 90 + 6 pages.

7673* Marking Metal Surfaces. II. A further selection of marking techniques currently used for metallic surfaces are reviewed, including a variety of manual and automatic mechanical methods, and chemical and electrolytic etching. ***D. J. Fishlock.*** *Metalworking Production*, v. 103, no. 12, Mar. 20, 1959, p. 487-490.

7674 Coated Semiconductor Is Tiny Neutron Detector. The authors have developed semiconductor neutron detectors less than 1/10 in. in diameter which can measure fast and thermal neutron fluxes in the range 10^4-10^{11} n/cm^2/sec with an adequate discrimination against associated gamma radiation, and have used the detectors to map the thermal-neutron-flux pattern in a low-power reactor core. ***R. V. Babcock, et al.*** *Nucleonics*, v. 17, Apr. 1959, p. 116 + 3 pages.

7675* Film Thickness Relationships of Organic Coatings. A summary of a research project performed recently in the Department of Chemical Engineering at Purdue University. ***John M. Wetz, Brage Golding, and L. C. Case.*** *Official Digest*, v. 31, Mar. 1959, p. 419 + 9 pages.

7676* Synthesis of Uniform Particle Size Styrene and Styrene-Butadiene Latexes for Paint Formulatoin Research. Review of older methods and development of some new methods for the above. ***A. H. Loranger, T. T. Serafini, W. von Fischer, and E. G. Bobalek.*** *Official Digest*, v. 31, Apr. 1959, p. 482-520.

7677* Free Film Properties of Epoxide Resin Coating Systems. Epoxy resin systems including air drying esters, phenol and urea-formaldehyde resin-cured compositions, and aliphatic polyamine-cured compositions have been examined as unsupported films of between 1 and 10 mils thickness. Stress-strain characteristics of these coatings during various stages of their cure and after accelerated or outdoor weathering are presented. ***Thomas F. Mika.*** *Official Digest*, v. 31, Apr. 1959, p. 521-543.

7678* Changes With Time in the Wash Primer WP-1 Composition. I. Variations in the Resin. A study of possible causes of deterioration of WP-1 has been made and a method for dissection of this heterogeneous wash primer has been developed. Centrifugation separated the insoluble pigmentary material from the resin-phosphoric acid solution. The centrifugate was analyzed for acidic material. Analysis showed that phosphoric acid had been consumed at a measurable rate. The resin indicated that changes do take place therein. ***S. M. Hirshfield and E. R. Allen.*** *Official Digest*, v. 31, Apr. 1959, p. 544-559.

7679* Measurement of Adhesion of Paint Films. A simple technique has been developed to measure the pressure necessary to lift a paint film from a substrate or another paint film. This pressure is a measure of the adhesion of the paint film. ***E. Hoffmann and O. Georgoussis.*** *Oil & Colour Chemists' Association, Journal*, v. 42, Apr. 1959, p. 267-269.

7680* The Difficulties Inherent in the Hardness Grading of Surface Coatings. In the field of industrial finishes, the grading of hardness by any of the established empirical or official methods is most unreliable. The specification of hardness has little significance in films of high scratch hardness. Recommends cooperative research projects based on simple steps, involving limited time by collaborators. ***J. B. Harrison.*** *Oil & Colour Chemists' Association, Journal*, v. 42, Apr. 1959, p. 270-276.

7681 How Paints Stand Up to Tropical Climates. II. Tropical conditions subject surface coatings to more severe effects of radiation and moisture than temperate climates. Attack from corrosive gases in the atmosphere is normally not so pronounced but in marine areas salt spray may be even more acute. Improvement in preparation and application are needed. ***P. Whiteley.*** *Paint Manufacture*, v. 29, Apr. 1959, p. 125-128.

7682 Some Experiences With Lead Pigments in Corrosion Resistant Paints. Calcium plumbate has many useful attributes as a component part of anti-corrosive paints. In some circumstances and for some applications, red lead pigment still gives the best results. *Paint Manufacture*, v. 29, Apr. 1959, p. 130-131.

7683* New Developments in Poly Extrusion Coating. Facts on how extrusion coating techniques can affect slipping and blocking in polyethylene converting operations; treatment of poly for printing and gluing, and recommended practices for coating on foil, cellophane, and paper substrates. ***E. E. Griesser and H. A. Arbit.*** *Paper, Film and Foil Converter*, v. 33, Apr. 1959, p. 30-33.

7684 Adhesion of Evaporated Aluminium Films With Underlayers of Nickel, Cobalt and Chromel. Thin layers of Ni, Co, and chromel are evaporated under vacuum on to glass microscope slides and used as underlayers for Al films. Adhesion measurements are used to investigate aging effects which are shown to depend upon temperature as well as the nature and thickness of the underlayer. Results are shown to be due to intermetallic compound formation at the interface causing a type of age-hardening. ***C. Weaver and R. M. Hill.*** *Philosophical Magazine*, v. 4, ser. 8, Feb. 1959, p. 253-266.

7685* Coatings for Vacuum Metallizing on Plastics. Current application techniques and formulations for top and base coatings are described, together with the future outlook. ***M. A. Self and John Scharnberg.*** *Plastics Technology*, v. 5, Mar. 1959, p. 32 + 4 pages.

7686 Barrel Enameling. Description of an economical method for painting large quantities of small parts. ***W. S. Field.*** *Products Finishing*, v. 23, no. 7, Apr. 1959, p. 40-42.

7687* Adhesion Effects in Bonding Rubber to Metal by Leukonat Adhesive. ***A. M. Medvedeva, B. V. Deryagin, and S. K. Zherebkov.*** *Rubber Chemistry and Technology*, v. 32, no. 1, Jan.-Mar. 1959, p. 67-76. (Translated from *Kolloidnyi Zhurnal*, v. 19, 1957, p. 412-420.)

7688 Molybdenum Coating Stands Up At 2000 Deg F. The oxidation problem of Mo at high temperatures has occupied the attention of many researchers in recent years. A new composite Cr-Ni coating, developed by National Bureau of Standards, may now pave the way for wider use of this metal. *Space/Aeronautics*, v. 31, no. 4, Apr. 1959, p. 97 + 2 pages.

7689* Hot Galvanization of Grey Cast Iron. By hot galvanizing for 2 to 3 minutes at 450 C, zinc coatings of 1.9 to 2.8 oz./sq. ft. can be deposited on grey cast iron. The chief reason for failures is insufficient surface preparation. (*In German.*) Die Feuerverzinkung von Grauguss. ***P. Debouté.*** *Werkstoffe und Korrosion*, v. 10, Mar. 1959, p. 148-151.

7690* Corrosion Testing of Paints With the Aid of Aerosols. The use of genuine aerosols for corrosion testing of protective paints offers advantages. Spraying is carried out by means of jets but with the aid of suitably constructed aerosol equipment. A 0.05% solution of NaCl with a CO_2 addition of 1 liter/hour is recommended as test medium. The corrosion test can be intensified by adding aggressive gases like CO_2, HCl, NH_3, and SO_2. (*In German.*) Korrosionsprüfung von Anstrichen mit Hilfe von Aerosolen. ***H. Anders.*** *Werkstoffe und Korrosion*, v. 10, Mar. 1959, p. 151-152.

See also: **7498** (pigment analysis); **7556** (tung oil); **8114** (finishing handbook 1959); **8379** (ultrasonic liquid atomization).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

7691 An Analytic Frequency-Response Solution for a Higher Order Servomechanism With a Nonlinear Control Element. This paper presents an effective method for evaluating the frequency response, both open-loop and closed-loop, for on-off-type feedback control systems with or without proportional bands. ***A. M. Hopkin and K. Ogata.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 81, no. 1, Mar. 1959, p. 41-45.

7692* The Arithmetic Translator-Compiler of the IBM Fortran Automatic Coding System. The present paper describes, in formal terms, the steps in translation employed by the Fortran arithmetic translator in converting Fortran formulas into 704 assembly code. ***Peter B. Sheridan.*** *Association for Computing Machinery, Communications*, v. 2, Feb. 1959, p. 9-21.

7693* Signal Corps Research and Development on Automatic Programming of Digital Computers. ***William F. Luebbert and Percy W. Collom, Jr.*** *Association for Computing Machinery, Communications*, v. 2, Feb. 1959, p. 22-27.

7694* Numerical Control of Production Machines. Considers the attributes of a good, practical system and possible advantages for small and variety-lot production. ***Wallace E. Brainard.*** *Automation*, v. 6, Apr. 1959, p. 61-66.

7695* Unique Card Reader Simplifies Programmed Transformer Testing. . . . and advantages include greater worker safety, increased accuracy at a lower cost, and improved recording of test results. Developmental by-products necessary to achieve these benefits include concepts, circuit designs, and equipment for other operations. ***J. J. Lahm and G. S. Pail.*** *Automation*, v. 6, Apr. 1959, p. 70-75.

7696* Dynamic Properties of Electric Pilot Vibration Servomechanism. The paper deals with an electric vibration servomechanism. Switching of speed in its servomotor is accomplished with electromagnetic clutches. Two instances are analyzed: when servomechanism motion is described by the first order equation and when it is described by the second order equation. The analysis yields parameters relations that characterize stability limit. (*In Russian.*) Dinamika vibratsionnogo servomekhanizma elektricheskogo avtopilota. ***I. N. Krutova.*** *Avtomatika i Telemekhanika*, v. 20, no. 2, Feb. 1959, p. 115-126.

7697* United Two-Drive Servosystems. The theory of united two-drive servosystems is expounded. Transfer functions and error coefficients of the systems mentioned are obtained. The experimental results of the analysis of the systems are presented. (*In Russian.*) Ob'edinennye slediashchie sistemy s dvumia privodami. ***P. F. Klubnikin.*** *Avtomatika i Telemekhanika*, v. 20, no. 2, Feb. 1959, p. 161-175.

7698* Electropneumatic Transducers. Block-diagrams of the transducers mentioned, their operation and experimental results are described. Error due to nonlinearity of the characteristic of the primary pneumatic relay is determined. The problem of amplification coeffiicent of the secondary amplification pneumatic relay is considered. Calculation of a temperature compensation circuit is presented. (*In Russian.*) Elektropnevmaticheskie preobrazovatelii AT AN SSSR. ***Iu. V. Krementulo.*** *Avtomatika i Telemekhanika*, v. 20, no. 2, Feb. 1959, p. 211-219.

7699* Noise Stability of Pulse Width and Pulse Time Telemetering With Great Fluctuation Noise. Mean and mean-square errors are taken for noise stability criteria. Distortions due to relatively strong noise in channels are analyzed by the method of signal sampling. Calculation formulae for noise stability estimation are obtained. Various telemetering devices are compared as to their noise stability. (*In Russian.*) Pomekhoustoĭchivost' shirotno-impul'snogo i vremia-impul'snogo teleizmereniia pri sil'nykh fluktuatsionnykh pomekhakh. ***N. V. Pozin.*** *Avtomatika i Telemekhanika*, v. 20, no. 2, Feb. 1959, p. 239-248.

7700* Design and Analysis of Single-Cycle Magnetic Logic and Trigger Commutation Circuits. An economic magnetic device is described which is built with square hysteresis loop ferrites. The device can perform various logic and commutation operations. Exemplary building and analysis is given of various types of trigger circuits and of the circuit of a binary counter. (*In Russian.*) Postroenie i analiz odnotaktnykh magnitnykh logicheskikh i triggernykh kommutatsionnykh skhem. ***Ia. G. Koblents.*** *Elektrosviaz'*, v. 13, no. 3, Mar. 1959, p. 73-81.

7701 Definitions. These definitions are a compilation from the various national steering committees. They are first draft in nature and have not been coordinated between the various interested bodies. Suggestions for new definitions are invited. ***Clifford M. Ryerson, compiler.*** Paper from "Fifth National Symposium on Reliability & Quality Control in Electronics, Proceedings", The Institute of Radio Engineers, New York. 1959, p. 161-178. (TK7801 N21p Over.)

7702* A New Concept in Computing. Describes a new computing scheme proposed by von Neuman. The concept of using the phase of a sine-wave signal as an information-bearing medium which together with majority logic permits the realization of logic operations is described in detail. ***R. L. Wigington.*** *I.R.E. Proceedings*, v. 47, Apr. 1959, p. 516-523.

7703* Time Optimal Control Systems. ***J. P. LaSalle.*** *National Academy of Sciences, Proceedings*, v. 45, Apr. 1959, p. 573-577.

7704* Information Transmission Rate, Carrying Capacity of a Multipath System and Reception by the Method of Linear-Operator Transformation. Theoretical investigation of the laws of increase in the capacity and information transmission rate of multipath communication systems. Sensible methods of forming output signal from output signals of a single channel are pointed out. (*In Russian.*) Skorost' peredachi informatsii, propuskhaya sposobnost' mnogopytevoy sistemy u priem po metodu lineĭno-operatornogo preobrazovaniia. ***I. A. Ovseevich and M. S. Pinsker.*** *Radiotekhnika*, v. 14, no. 3, Mar. 1959, p. 9-21.

7705* Small-Size Universal Digital Computer With Magnetic (Ferrite) LEM-1 Elements. A description of the structure and performance of a small universal digital computer with contactless magnetic (ferrite) and capacitive "DEZU" (long-time capacitive memory unit) elements. (*In Russian.*) Malogabaritnaia universal'naia tsifrovaia vychislitel'naia mashina na magnitnykh (ferritovykh) elememtakh LEM-1. ***Iu. A. Makhmudov.*** *Radiotekhnika*, v. 14, no. 3, Mar. 1959, p. 47-57.

7706* Reliability Calculation by the Synthetic Selections Method. A brief theoretical study on the synthetic selections method of calculating the operational reliability of electronic circuits. (*In Russian.*) Raschet nadezhnosti metodom sinteticheskikh vyborok. *Zarubezhnaia Radioelektronika*, 1959, no. 2, Feb., p. 19-24.

See also: **7895** (automation in U processing).

ELECTRICAL ENGINEERING

7707 A Review of Gaseous Dielectric Development. A nontechnical review of the development of gaseous dielectrics. Topics discussed are history, action of gas insulators, problems in choosing a suitable gas, established uses for SF_6, and new gaseous dielectrics. ***F. L. Holloway and W. H. Mears.*** *Electrical Engineering*, v. 78, Feb. 1959, p. 137-140.

7708 Electrospherics and Magnetospherics. I-II. Discusses the interesting and dramatic effects displayed when tiny spheres, usually of magnetic material, move or are driven over the surface of a dielectric. Demonstrations of these phenomena may be made by simple means and at low cost, in terms of the equipment described. Not only are the results interesting in themselves, but also it is hoped that they may serve as analogs for such phenomena as Brownian movement, thermal movement of molecules, crystal formation, bacterial chaining, and others. ***A. D. Moore.*** *Electrical Engineering*, v. 78, Feb. 1959, p. 148-155; Mar. 1958, p. 229-235.

7709* Realistic Temperature-Power Derating Requirements for Carbon-Composition Resistors. Weaknesses of derating curves in MIL specifications and manufacturers' literature are discussed, and two new methods are described and statistically analyzed. The first method indicates degradation of the resistor at high temperature in terms of the deviation of the resistance from the initial value as a function of load for a life of 2000 hrs; the second method indicates the derating requirements for a maximum of 20% resistance deviation from nominal during 2000 hrs of life. ***J. L. Easterday and H. Braner.*** *Electrical Manufacturing*, v. 63, Mar. 1959, p. 141 + 5 pages.

7710* Calculation of the Parameters of Cables With Bimetallic Core Wires. Describes a method of calculating resistance and inductance of circuits made of cables with bimetallic core wires. The method takes into account the effect of core wires drawing close to one another (the approach effect). Auxiliary tables are compiled for copper-clad steel wires. (*In Russian.*) Kraschetu parametrov kabeleĭ s bimetallicheskimi zhilami. ***I. E. Efimov.*** *Elektrosviaz'*, v. 13, no. 3, Mar. 1959, p. 91-96.

7711* Cadmium-Silver and Silver Cadmium Oxide Contacts. Defects were removed from cadmium silver contact materials by oxidation; as a result these materials can be used in very versatile ways with very low loss of metal and tendency to weld. Recently bimetal contacts of oxidized cadmium silver have been manufactured. (*In German.*) Kontakte aus Kadmium-Silber und Silber-Kadmium-Oxyd. ***Rudolf Richter.*** *ETZ: Elektrotechnische Zeitschrift*, v. 11, Ausgabe B, no. 2, Feb. 1959, p. 38-40.

7712 Fifth National Symposium on Reliability & Quality Control in Electronics, Proceedings. Consists of 50 papers discussed at the symposium in Philadelphia, Pa., January 12-14, 1959. 451 pp. 1959. The Institute of Radio Engineers, New York. (TK7801 N21p Over.)

7713* Malleable Iron. A Magnetic Alloy. Malleable iron is well-known for its strength, toughness and machinability, and is frequently specified where these properties are of prime importance. Malleable iron also has excellent magnetic properties, and although it has been specified for electromagnetic applications designers have not had, in one place, data available to them on the magnetic properties. This paper is presented to correct that situation. ***W. K. Bock.*** *Modern Castings*, v. 35, Apr. 1959, p. 61-68.

7714* Electrical Properties of Dilute Alloys of Zinc With Manganese at Low Temperatures. ***Yoshio Muto, Yoshio Tawara, Yoshio Shibuya, and Tadao Fukuroi.*** *Physical Society of Japan, Journal*, v. 14, Mar. 1959, p. 380-381.

7715* Carbonyl Iron Powder Magnetodielectric Materials. The manufacturing technique of magnetic cores for Pupin coils, K22 coils and cup type cores. Properties of materials employed, methods of insulation, design of equipment, and methods of measurement of magnetic properties are described. The addition of mica dust in order to improve the magnetic properties of cores was especially emphasized. For K22 type cores the following properties were obtained: permeability – $\mu = 55$ Gs/Oe; loss values – $\delta_h = 4.5 \times 10^{-5}$ 1/Oe, $\delta_f = 25 \times 10^{-5}$ 1/Gs. (*In Polish.*) Magnetodielektryki z proszku żelaza karbonylkowego. ***M. Waltenberger, L. Siazewski, and B. Affeltowicz.*** *Prace Instytutów Hutniczych*, 1959, no. 1, p. 41-50.

7716* Survey of Siemens Telemetering Methods for Power Supply and Distribution. A brief review of the possibilities and performance of the available transmission paths for telemetering the instantaneous state of power-supply networks. ***Erwin Kraushaar.*** *Siemens Review*, v. 26, no. 2, 1959, p. 43-48.

See also: **7466** (hard rubber applications); **7701** (definitions); **8209** (electrical resistivity of $CuAu_3$)

ELECTROCHEMISTRY

7717 Design Characteristics of Hard-Anodize on Aluminum. Design parameters and case histories are presented. ***Jerome Collins.*** *Electrical Manufacturing*, v. 63, Apr. 1959, p. 161-163.

7718 Production of Electrolytic Copper Powder. A detailed description of the operation, equipment, and quality control used in the commercial production of electrolytic copper powder is presented. The effect of electrochemical and mechanical variables on the physical characteristics of electrolytic copper powder is also reviewed. ***Frank Wills and E. J. Clugston.*** *Electrochemical Society, Journal*, v. 106, Apr. 1959, p. 362-366.

7719* Some Experimental Observations on the Effect of Addition Agents on Stress and Cracking in Rhodium Deposits. The origins of internal stress in electrodeposits are briefly reviewed. The effects of aluminum and magnesium sulfate and of selenic acid on the stress and cracking of rhodium deposits from sulfate electrolytes are described. Aluminum and magnesium additions eliminated cracks in deposits up to at least 0·0005 in. thick, but no corresponding reduction in tensile stress (40-50 ton/in^2) was observed in measurements on flexible strip cathodes. ***F. H. Reid.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 3, Spring 1959, p. 74-81.

7720* Electroless Palladium Plating. A process is described for the deposition of Pd by chemical reduction on catalytic surfaces. Most metals are effective catalysts for this reaction. The deposited Pd is also catalytic, so thick coatings can be deposited. This plating solution comprises as essential ingredients a palladium-amine complex, a reducer, and a stabilizing agent. The Pd deposits are ductile, adherent, and pure; they are also free from blistering on heating. The electroless feature of the bath permits development of a uniform thickness of deposit on geometrically complex articles. ***Richard N. Rhoda.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 3, Spring 1959, p. 82-85.

7721* The Properties of Bright Nickel Electrodeposits in Relation to the Period of Service of the Plating Bath. III. Composition and Microstructure. Carbon, oxygen, hydrogen, and nitrogen contents of bright nickel deposits from two proprietary solutions were determined by chemical analysis. The amount of organic material incorporated in the deposits tended to increase with increasing length of service of the plating bath. For both types of bright nickel there seemed to be a definite relationship between the ductility of the deposits and the amount of material (addition agents and impurities) included in them. The results indicate that additions of anti-stress agent made periodically to one of the solutions, which tended to lower stress and raise ductility, reduced the total amount of organic material in the deposit. This requires confirmation, but could have important practical and theoretical implications. ***J. Edwards.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 3, Spring 1959, p. 86-92.

7722* Electrodeposition of Copper-Nickel Alloys From Citrate Solutions. Sound, adherent deposits of Cu-Ni alloys may be produced from solutions containing Cu and Ni sulfates and trisodium citrate. The composition of the deposit is dependent on both the composition of the solution and the cathode current density, but is not markedly affected by variations in temperature or by agitation of the solution. In solutions containing a small proportion of chloride, the anode efficiency is substantially 100%, but the cathode efficiency varies from 50% to 80%, depending on electrolyte composition, temperature, and current density. The hardness and contractile stress of an alloy deposit containing 55 Cu/45 Ni is somewhat greater than that of Ni deposited from a Watts solution. Preliminary throwing-power measurements have indicated that the solution is capable of very uniform metal distribution. ***B. H. Priscott.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 3, Spring 1959, p. 93-96.

7723* Structure and Growth of Iron and Chromium Electrodeposits on Copper Single-Crystal Faces. ***A. K. N. Reddy and H. Wilman.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 3, Spring 1959, p. 97-106.

7724 Surface Treatment of Aluminium. Discussing some problems of producing anodic films on aluminium. ***F. Flusin.*** *Metal Industry*, v. 94, Apr. 17, 1959, p. 303 + 2 pages.

7725 Investigations on "Active Iron". I. Isolation. Following the observation that Fe deposited electrolytically under certain conditions appears to have an unusually high chemical reactivity, the author reviews previous work on iron-water reactions and sets out the electrolytic conditions for depositing "active iron". ***G. V. L. N. Murty.*** *Metallurgia*, v. 59, Mar. 1959, p. 141-142.

7726 An Introduction to Fundamental Research on the Mechanism of the Electrodeposition of Metals. An attempt is made to explain the type of work done in fundamental research on the mechanism of metal deposition. The object is to ascertain: (a) the structure of the electric double-layer, (b) the structure of ions in solution which give rise to electrodeposited entities, (c) the path and rate-determining step in the metal deposition. An explanation of the technical terminology of the work is given in an appendix. Particular techniques, especially pre-electrolysis, and the introduction of clean surfaces into the solution, are discussed. Some experimental results of one fundamental investigation on the ac impedance of the copper solution interface are given. The interpretation of these results is briefly discussed. They are consistent with the view that the transfer of ions is largely rate determining except near the reversible potential. It is also possible to make a purely theoretical approach to metal deposition kinetics and the type of result ensuing from this is described. ***B. E. Conway and J. O'M. Bockris.*** *Plating*, v. 46, Apr. 1959, p. 371-383.

7727 Lead Plating of Chrome Plating Anodes. Initial studies were conducted on a laboratory scale to develop a process for the continuous lead plating of round copper bars, 2 in. in diameter, 17 ft. 6 in. in length for producing chrome plating anodes. Later investigation was expanded to full scale plating. The first work resulted in the production of two successful chrome plating anodes. A comparison of the old and new methods of fabrication indicates the lead plated anode to be superior, not only in tangible monetary savings, but also in increased safety in working conditions. Data presented also show that the lead plating results in anodes having greater chrome plating accuracy and increased life. ***Francis A. Heiser and James E. Hyde.*** *Plating*, v. 46, Apr. 1959, p. 385-388.

7728 An Effective Protective Coating for Molybdenum. A composite electrodeposited coating of Ni over Cr protects Mo from high-temperature oxidation. *Products Finishing*, v. 23, no. 8, May 1959, p. 60 + 5 pages.

7729 Horizons, Inc., Production of High Purity Thorium Metal by Fused Salt Electrolysis. Horizons, Inc., under a four-year research and development contract with the United States Atomic Energy Commission, has successfully piloted a completely integrated process for the production of high quality thorium metal by the continuous fused-salt electrolysis of thorium chloride dissolved in sodium chloride. ***Bertram C. Raynes.*** *U. S. Atomic Energy Commission, BNL-483* (C26), Jan. 9-10, 1958, p. 109. (UF767 Un3.1bn Contin.)

See also: **7673** (electrolytic metal marking).

ELECTRONICS

7730* The Action of a Progressive Perturbation on an Electromagnetic Guided Wave. A theoretical study is presented on some physical problems which arise from the interaction of vibration modes. Solutions to the equation of propagation of electromagnetic waves in the disturbed medium are obtained by using the so-called perturbation method. The use of the boundary conditions for linkage with the unperturbed medium provides a unique solution. (*In French.*) Action d'une perturbation progressive sur une onde électromagnétique guidée. ***J.-C. Simon.*** *Annales de Radioélectricité*, v. 14, no. 55, Jan. 1959, p. 3-16.

7731* New Applications of Ferrites at Ultrahigh Frequencies. Two arrangements are described which extend the domain of microwave applications of ferrites. Coaxial waveguides partially filled with a dielectric can be used for the construction of ferrite coaxial isolators for 2000 and 1300 Mc. The Faraday effect on a circular waveguide makes it possible to produce rapid modulation in a waveguide. By means of the apparatus described, it is possible to construct single sideband modulators which at 10,000 Mc permit frequency deviations of the order of several megacycles and even more. (*In French.*) Nouvelles applications des ferrites en hyperfréquences. ***F. Dachert, J. Robieux, and P. Trévoux.*** *Annales de Radioélectricité*, v. 14, no. 55, Jan. 1959, p. 17-30.

7732* "Optimization" of Direction Finding Elements in Automatic Tracking Radars Mounted on Mobile Platforms. Various methods are compared and evaluated which can be used to secure stabilization in problems relating to mobile automatic tracking radar installations. It is shown that these various methods are based on the same general principles. The influence of amplitude/amplitude linearity of tachymetric transducers is considered in the anticipation control systems and in direct action circuits. (*In French.*) "Optimisation" des éléments de pointage en direction dans un radar de poursuite automatique dont la tourelle est montée sur plate-forme mobile. ***G. Révillon.*** *Annales de Radioélectricité*, v. 14, no. 55, Jan. 1959, p. 31-46.

7733* A Contribution to the Study of the Structure of Small-Size Semiconductors at Low Temperatures. An exact theory is presented of the breakdown phenomenon in *p-n-p* (or *n-p-n*) transistors in the weak-current region. An exact definition of the breakdown voltage is given and the law of its variation with temperature is established. An experimental investigation is described, the results of which fully confirm the theory proposed. (*In French.*) Contribution a l'étude des structures semi-conductrices de faibles dimensions a basses températures. ***O. Garreta.*** *Annales de Radioélectricité*, v. 14, no. 55, Jan. 1959, p. 47-72.

7734* The Radar Appearance of a Rotating Corner Reflector. Presents conclusions reached regarding the radar appearances of an artificial earth satellite moving in an equatorial orbit of low eccentricity. ***Robert J. Davis.*** *Astronautica Acta*, v. 5, no. 1, 1959, p. 1-14.

7735* Techniques of Analysing Terrestrial Radio and Optical Observations of Earth Satellites. A description of the main features of radio interferometer and kinetheodolite observations of satellite orbits. Outlines a digital computer method for observations analysis, together with accuracy estimates for determination of a satellite's position. Includes table of orbital elements of the 2nd Russian satellite and compares theoretical and observed values of rate of rotation of the orbital plane. These differ by 0.7%. ***R. H. Merson.*** *Astronautica Acta*, v. 5, no. 1, 1959, p. 26-39.

7736 The TJ Radio System. Describes the latest Bell Telephone Laboratories' TJ Radio System which operates in a frequency band at 11,000 mc to transmit efficiently short-haul

telephone, television, SAGE, and similar signals. ***S. D. Hathaway and H. H. Haas.*** *Bell Laboratories Record*, v. 37, Apr. 1959, p. 129-133.

7737 A Faraday Rotation Switch for the TH System. Describes the structure and operating principle of an efficient, fast-acting ferrite-activated switch, based on the Faraday rotation principle, used for protection circuits of the TH communication system. ***Jerald A. Weiss.*** *Bell Laboratories Record*, v. 37, Apr. 1959, p. 139-143.

7738* A Transistorized Compandor. Describes the design of the Stromberg-Carlson type 545 compandor for general use in voice transmission communication circuits. ***J. C. Perkins, Jr., D. A. Perreault, and A. F. Perkins.*** *Communication and Electronics*, 1959, no. 40, Jan., p. 791-797.

7739* Recent Progress in Applying Information Theory to Digital Transmission Systems. Recent investigations indicate that careful observation of the detection theory, of the definition of digital systems, of the size of the signaling alphabet, and of the conversion process from low-pass signals to band-pass (carrier) signals may be extremely helpful for faster progress in applying information theory to digital communication systems. ***R. Filipowsky.*** *Communication and Electronics*, 1959, no. 40, Jan., p. 848-855.

7740* Volt-Second Transfer Efficiency in Fast-Response Magnetic Amplifiers. I. N^2/R and Control. The object of this paper is to extend the volt-second control approach into the region of finite signal resistance and non-ideal flux-current loops for fast-response amplifiers. ***T. J. Pula.*** *Communication and Electronics*, 1959, no. 40, Jan., p. 861-867.

7741* A Magnetic-Amplifier Commutating and Pulse-Width Encoding Circuit. Describes a special electric commutating circuit designed to replace the mechanical commutators now used in many telemetering systems. ***W. H. Lucke.*** *Communication and Electronics*, 1959, no. 40, Jan., p. 884-892.

7742* Linear Power Amplifiers Using Dynistors or Trinistors. Describes two of the many possible magnetic-amplifier transducers and one of the many possible trinistor output circuits of the dynistor and trinistor linear power amplifiers. ***Frank J. Hierholzer, Jr.*** *Communication and Electronics*, 1959, no. 40, Jan., p. 892-898.

7743* Radio Attenuation at 11 Kmc and Some Implications Affecting Relay System Engineering. Describes the 2-stage transistor preamplifier capable of achieving, with a minimum of components, d-c stability under extremes of transistor characteristics changes such as occur between transistors and over a temperature range. ***S. D. Hathaway and H. W. Evans.*** *Communication and Electronics*, 1959, no. 40, Jan., p. 930 + 10 pages.

7744* Theory of Transient Build-Up in Avalanche Transistors. An analysis is presented, the results of which show that an avalanche transistor biased into the negative resistance range will deliver an exponentially increasing current into a capacitor connected between the emitter and collector. ***W. Shockley and J. Gibbons.*** *Communication and Electronics*, 1959, no. 40, Jan., p. 993-998.

7745* On Feedback in Magnetic Amplifiers. I. Single Feedbacks. An investigation is described of a variety of feedback configurations that are associated with 2-core full-wave self-saturating amplifiers. The present study is limited to resistive loads and feedback networks without frequency-dependent elements. ***L. A. Finzi and J. J. Suozzi.*** *Communication and Electronics*, 1959, no. 40, Jan., p. 1019-1031.

7746* Transistor Phase-Locked Oscillators. Circuit design and performance analysis are described of two recently developed, completely transistorized phase-locked oscillator systems for the detection and tracing of signals in the presence of noise. ***K. A. Edwards, O. Golubjatnikov, and D. J. Brady.*** *Communication and Electronics*, 1959, no. 40, Jan., p. 1043-1051.

7747* 1957 Magnetic Amplifier Bibliography. AIEE Committee report. List of journals and their abbreviations is presented that covers domestic and foreign literature for the year 1957. Some articles from the year 1956, not previously listed are also included. *Communication and Electronics*, 1959, no. 40, Jan., p. 1051-1057.

7748 Improving Stability of AM Directional Antenna Systems. Covers important design factors. ***G. H. Brown.*** *Electrical Engineering*, v. 78, Mar. 1959, p. 214-217.

7749 Microwave by Wire. Practical examples are given for G-Line components and complete G-Line systems. ***T. Hafner.*** *Electrical Engineering*, v. 78, Mar. 1959, p. 220-224.

7750 Overcurrent Protection of Semiconductor Rectifiers. A summary is presented of various common protective schemes and of the types of faults against which they can be designed to protect the rectifier cells. ***F. W. Gutzwiller.*** *Electrical Manufacturing*, v. 63, Apr. 1959, p. 106-114.

7751 R-F Measurements on Ferrite Cores. A study is presented of several effective means of making measurements at frequencies from 2½ to 30 mc of the relative permeability and quality factor, Q, of ferrite ring samples ranging in size from ¾ to 2⅝ in. diam. Theory of measurement by resonance and impedance methods using a cavity-inductor is included. ***Pietro P. Lombardini and Richard F. Schwartz.*** *Electrical Manufacturing*, v. 63, Apr. 1959, p. 148-155.

7752* Cathode Compensation. The necessary design equations are derived and curves plotted which show the relationship between the various aspects of the performance of the cathode-compensated pentode video stage. It is shown that such a stage can give a considerable improvement in rise-time over that obtained with critical compensation ($a = 1$) if some overshoot is permitted. ***H. D. Kitchin.*** *Electronic & Radio Engineer*, v. 36, Apr. 1959, p. 122-128.

7753* Response of Cascaded Double-Tuned Circuits. The transient and steady-state responses of cascaded identical double-tuned circuits are developed in terms of the locations of the poles of the transfer function. ***Yona Peless.*** *Electronic & Radio Engineer*, v. 36, Apr. 1959, p. 134-140.

7754* Transistor Junction Temperature. Continuous Measurement in Class C Circuits. A circuit is described which can be interposed between the driving source and the output stage in class C transistor circuits in order to measure the temperature-dependent base leakage current. The circuit permits a continuous measurement of junction temperature without disturbing the normal operation of the class C circuit. ***H. Sutcliffe and D. J. Matthews.*** *Electronic & Radio Engineer*, v. 36, Apr. 1959, p. 143-144.

7755* Transmission of Power in Radio Propagation. Some remarks concerning the theoretical foundations of the transmission-loss concept are made. It is emphasized that the influence of the ground on the input resistances of the transmitting and receiving aerials must be accounted for. ***James R. Wait.*** *Electronic & Radio Engineer*, v. 36, Apr. 1959, p. 146-150.

7756 Electronic Circuits. Presents a unified treatment of vacuum tubes and transistors. ***E. J. Angelo, Jr.*** 450 pp. 1958. McGraw-Hill, New York. (TK7870 An4.3e)

7757 Linear Multi-Tapped Potentiometers With Loaded Outputs. An analysis of multi-tapped linear potentiometers is given for the type where shunt resistors are connected between adjacent tapping points, and in the presence of an output load resistance. A procedure for designing potentiometers to generate non-linear functions is suggested. ***K. C. Garner.*** *Electronic Engineering*, v. 31, Apr. 1959, p. 192-199.

7758 Transistor Amplifier for Magnetic Tape and Drum Playback. The problems involved in the realization of such an amplifier are discussed. An analysis is given and the design procedure is worked out. The test results of a prototype amplifier are described. ***A. E. Bachmann.*** *Electronic Engineering*, v. 31, Apr. 1959, p. 213-217.

7759 Exploiting Other Communications Media. To relieve the overcrowded existing facilities for radio communications, the use of light, heat, gamma rays and other media is proposed. ***Joseph L. Ryerson.*** *Electronic Industries*, v. 18, Mar. 1959, p. 79-83.

7760 Increasing the Input Impedance in Transistor Amplifiers. Transistor amplifier circuit is described which can exchange voltage gain for input impedance by using negative feedback. In addition, voltage gain can be made more independent of transistor by the same circuitry. ***Arthur D. Evans.*** *Electronic Industries*, v. 18, Mar. 1959, p. 84-86.

7761 How to Measure Wide Band Impedance. Discusses basic principles and some techniques that allow an increase in measurement accuracy in the use of the sweep frequency, delay line method of testing electronic equipment. ***Ken A Simons.*** *Electronic Industries*, v. 18, Mar. 1959, p. 87-92.

7762 System Designing Communicating in Space. Known techniques and experimental data on the design of space communication systems are analyzed from the over-all and performance point of view. ***Leang P. Yeh.*** *Electronic Industries*, v. 18, Mar. 1959, p. 94-99.

7763 Tubes or Transistors? Extracts from the available data on vacuum tubes and transistors and a list of references giving more detailed information are presented to allow a realistic assessment of performance and reliability factors of interest to the designer of electronic equipment. ***Robert E. Moe.*** *Electronic Industries*, v. 18, Apr. 1959, p. 58-63.

7764 Designing RDF Antennas. Describes the various techniques, basic design data, and relative merits and deficiencies of the different systems of RDF antennas. ***Richard C. Benoit, Jr. and Francis Coughlin, Jr.*** *Electronic Industries*, v. 18, Apr. 1959, p. 77-83.

7765 Miss Distance Indicator Scores Missile Accuracy. Describes how separation between missile and target within 10- to 3,990-foot range is measured electronically using non-radar technique. ***J. A. Adams.*** *Electronics*, v. 32, no. 16, Apr. 17, 1959, p. 42-45.

7766 Scan Converter Aids Phone-Line Radar Relay. Remote radar system transmits information over narrow-band lines using storage method of bandwidth compression. Narrow-band television relay equipment built for the CAA Technical Development Center is described. ***Harry W. Gates and Allen G. Gatfield.*** *Electronics*, v. 32, no. 16, Apr. 17, 1959, p. 48-51.

7767* Synthesis of Active RC-Filters From the Given Transmission Conductance. Disadvantages of passive RC-filters are analyzed and two methods are described for the synthesis of active RC-filters, using a gyrator two-terminal pair network, in one case, and a converter of negative resistance, in the second case. The converter circuit, stable at the short-circuiting of its input terminals, is analyzed. (*In Russian.*) Sintez aktivnykh R-C fil'trov po zadannoĭ provodimosti peredachi. ***G. L. Khazanov.*** *Elektrosviaz'*, v. 13, no. 3, Mar. 1959, p. 63-72.

7768 Development of Accelerated Life Test Procedures for Carbon Composition Resistors. After reliability information has been obtained from simulated-use life tests on component parts, the question of the reliability of future production lots of components remains to be answered. This paper describes a 1000 hour exploratory accelerated test for ½-watt carbon composition resistors. A method of statistically testing to determine if true acceleration was achieved is illustrated using test data obtained. Recommendations for further development are included. ***B. C. Spradlin and H. M. Braner.*** Paper from "Fifth National Symposium on Reliability & Quality Control in Electronics", The Institute of Radio Engineers, Inc., New York. 1959, p. 307-318. (TK7801 N21p Over.)

7769* Survey of the Gibraltar-United Kingdom Ionospheric Scatter Measurements. Describes the performance of the Gibraltar-United Kingdom circuit working on forward scatter in the ionosphere. Aerial input powers up to 40 kW have been used and observations made on frequencies in the range 37 to 70 Mc/s and at distances in excess of 1100 miles. The scope of the work undertaken by various interested organizations is outlined and the main conclusions are given. ***F. A. Kitchen and G. Millington.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 2-6.

7770* A Scatter-Signal Analyser. The paper describes a scatter signal analyzer which enables level and time-structure measurements to be made on scatter propagation signals. The analyzer may be used to measure amplitude distributions, median aerial gains, signal auto- and cross-correlations, fading rates and, in some circumstances, error rates. ***P. H. Cutler and D. Williams.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 7-11.

7771* The Choice of Aerial Height for Ionospheric Scatter Links. The effect of variations of the circuit length, the height of the ionospheric scattering and the refraction which occurs in the troposphere is discussed. It is shown that probable variations of ionospheric height and refraction are unimportant for circuits up to about 1100 miles in length. ***E. Fitch and R. Ruddlesden.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 12-18.

7772* The Structure of High-Frequency Ionospheric Scatter Signals. The paper reports measurements of amplitude distribution, lateral correlation, diversity effects and error rates of ionospheric scatter signals at a frequency near 70 Mc/s. The results are discussed and it is concluded that a markedly non-Gaussian signal occurs at some times. The effects of signal structure are examined and some information on the diurnal variation of cosmic-noise intensity is given. ***D. Williams.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 19-26.

7773* Radio Interference as a Factor in Ionospheric Scatter Communication. The purpose of the paper is to draw attention to the many sources of interference which have been identified and, where possible, give information regarding its effect upon ionospheric scatter communication services. ***G. A. Isted.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 27-35.

7774* Analysis of Gibraltar-United Kingdom Ionospheric Scatter Signal Recordings. An analysis is presented of the recordings of ionospheric scatter signals received at East Hanningfield, Essex, from the experimental transmitter at Gibraltar. ***G. A. Isted.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 36-44.

7775* Polar-Diagram Requirements for Aerials for Communication by Ionospheric Scatter. Diagrams showing the mutually visible zone are presented for path lengths between 1200 and 1800 km. Diagrams showing the delay in transmission for paths off the great circle are presented. The required polar diagram in the horizontal plane is discussed in detail for a path length of 1200 km. Protection against interference to or from distant stations is discussed. Requirements for the reflecting surface (land or sea) are investigated. ***D. H. Shinn.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 45-52.

7776* The Angular Distribution of Energy Received by Ionospheric Forward Scattering at Very High Frequencies. A preliminary account is presented of the results of observational work on finding the angular power spectrum or distribution of the incident waves. ***W. C. Bain.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 53-55.

7777* The Direction and Amplitude of Reflections From Meteor Trails and Sporadic-E Ionization on a 1740 km North-South Path at Very High Frequencies. The results are presented of the measurements of the direction of arrival and amplitude of the v.h.f signal reflections from meteoric trails. ***R. W. Meadows.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 56-64.

7778* Amplitude of Very-High-Frequency Signals Reflected From the Sporadic-E Layer in North-West Europe. An analysis is given of the results of the measurements, made at Banbury of the strength of the high-level signals occasionally received from an Iceland transmitter operating on a frequency of 37 Mc/s. ***P. J. Brice.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 70-72.

7779* A Survey of Tropospheric Wave Propagation Measurements by the B.B.C., 1946-1957. The paper describes beyond-the-horizon tropospheric wave propagation measure-

ments made by the B.B.C. Research Department during the years 1946-1957. ***R. A. Rowden, L. F. Tagholm, and J. W. Stark.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 84-90.

7780* The Measurement and Prediction of V.H.F. Tropospheric Field Strengths at Distances Beyond the Horizon. An account is given of a series of measurements made since 1948 by the Post Office at receiving sites within the United Kingdom. Particular attention is given to the concept of angular distance and to the effect of path profile on the medium levels of field strength, as well as on the range of fading observed. ***J. K. S. Jowett.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B. Supplement No. 8, 1958, p. 91-96.

7781* The Effects of Atmospheric Discontinuity Layers up to and Including the Tropopause on Beyond-the-Horizon Propagation Phenomena. Description and interpretation of the results of the field-strength measurements at distances extending far beyond the horizon from a transmitter on a frequency of 91.3 Mc/s carried out in an aircraft flying at heights of about 10,000 ft. ***B. J. Starkey, W. R. Turner, S. R. Badcoe, and G. F. Kitchen.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 97-105.

7782* Some Investigations of Metre-Wave Radio Propagation in the Trans-Horizon Region. Describes the results of the investigation of the characteristics of metric radio transmissions in the trans-horizon region, at ranges up to 400 nautical miles. The results obtained indicate the essentially continuous existence of troposphere-supported signal components in this region, although their detailed characteristics are subject to variations. ***F. A. Kitchen, E. G. Richards, and I. J. Richmond.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 106-116.

7783* The Reduction of Threshold by the Use of Frequency Compression. The paper shows that the threshold level depends only on the combined bandwidth of the r.f. and i.f. circuits, and is unaffected by the existence of the frequency-compression loop. Thus, such a receiver enables one to combine the large f.m. improvement of the wide deviation signal with the low threshold of the narrow i.f. band. ***A. J. Buxton and M. O. Felix.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 117-121.

7784* Propagation Measurements at 3480 Mc/s Over a 173-Mile Path. Describes the results of an experimental study of beyond-the-horizon radio scatter propagation at a frequency of 3480 Mc/s over a path of 173 statute miles between Start Point and Wembley. Propagation data, collected from May, 1956, to April, 1957, are presented. The effects produced by aircraft flying through the beam are discussed, and a series of tests in which a naval aircraft flew both along and transversely across the transmission path are described. ***B. C. Angell, J. B. L. Foot, W. J. Lucas, and G. T. Thompson.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 128-142.

7785* Some Tropospheric Scatter Propagation Measurements and Tests of Aerial Siting Conditions at 858 Mc/s. Describes performance of a tropospheric scatter link has been in operation for three months over a 98-mile path and for eight months over a 200-mile path at a frequency of 858 Mc/s. Height/gain and space-diversity tests are described, and a comparison is made of signals received at four sites of very different aspects within the same locality. The disturbing effect of local flying is investigated and discussed. ***G. C. Rider.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 143-152.

7786* The Long-Range Propagation of Radio Waves at 10 cm Wavelength. A survey is presented of the results obtained in a series of short-term experiments on the propagation of 10 cm radiation over clear sea paths to distances well beyond the diffraction region, under a variety of weather conditions. Analysis of the amplitude distributions of some of the received signals confirms that propagation to ranges in the extra-diffraction region was due to a scattering process. ***W. R. R. Joy.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 153-157.

7787* Radio Propagation Far Beyond the Horizon at About 3·2 Cm Wavelength. Describes the results of measurements on transmissions of 3·2 cm wavelengths at ranges far beyond the radio horizon has been made over various paths, at arbitrary periods of time. The results obtained have established the existence of an essentially permanent extra-diffraction signal field and of some factors affecting the long-range propagation of 3·2 cm waves through the lower atmosphere which are incompletely understood. ***W. R. R. Joy.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 158-164.

7788* A Review of Tropospheric Scatter Propagation Theory and Its Application to Experiment. A comprehensive review is made of published work on the theory of beyond-horizon propagation of radio waves by means of oblique scattering from randomly-distributed irregularities of refractive index in the troposphere. A scattering theory is formulated which attempts to take as accurate an account as possible of all effects likely to be important in practice. ***M. A. Johnson.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 165-176.

7789* The Estimation of Transmission Loss in the Trans-Horizon Region. The expression for the scattering cross-section derived by Batchelor has been integrated over the useful scattering volume for transmitting and receiving aerials aligned on a great-circle path, and formulae have been derived for the transmission loss. ***E. G. Richards.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. B, Supplement No. 8, 1958, p. 177-183.

7790* The Use of Dispersive Artificial Dielectrics in a Beam-Scanning Prism. The final direction of a radiated beam made to pass through a dispersive prism is frequency sensitive and beam scanning can be achieved by frequency modulation. Two types of dispersive artificial dielectrics are considered for use in such a prism. Measured values of the electrical constants of both arrays over a wide range of wavelengths are included, and the properties of the beam-scanning prism are described in detail. ***J. S. Seeley and J. Brown.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 26, Mar. 1959, p. 93-102.

7791* Theory of Reflections From the Rodded-Type Artificial Dielectric. It is demonstrated that a composite material of a solid dielectric with embedded conductors can give a wave impedance equivalent to that of free space, and thus eliminate interface reflections. A particular material, the rodded dielectric, is analyzed, and design procedures are given. Methods of manufacture, and the tolerances required, are discussed. ***A. Carne and J. Brown.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 26, Mar. 1959, p. 107-115.

7792* An Investigation of the Excitation of Radiation by Surface Waves. The graphical method of measuring a reflection coefficient through a junction, originated by Deschamps, is used to determine the transmission efficiency of a surface wave at a discontinuity. It is shown that the discontinuities cause the radiation of an appreciable fraction of the incident power. ***K. P. Sharma.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 26, Mar. 1959, p. 116-122.

7793* The Launching of Radial Cylindrical Surface Waves by a Circumferential Slot. The efficiency with which radial cylindrical surface waves may be launched by a circumferential slot is investigated theoretically and experimentally. An optimum efficiency of about 68% is obtainable with a slot of 2 cm radius above a 58-ohm reactive surface. ***J. Brown and K. P. Sharma.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 26, Mar. 1959, p. 123-128.

7794* Parallel-Plate Transmission Systems for Microwave Frequencies. The paper gives a practical account of parallel-plate, or strip, transmission lines. The different types of strip line are considered and their basic characteristics summarized. Transducers to conventional systems and various circuit-elements are described and manufacture by photo-etching is outlined. ***A. F. Harvey.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. B, no. 26, Mar. 1959, p. 129-140.

7795* Optical Techniques at Microwave Frequencies. The application of optical principles and techniques at microwave frequencies is reviewed and a brief discussion of radiation and diffraction in the far and near fields is given. Various types of artificial dielectric and methods for reducing and enhancing surface reflectivity are examined. ***A. F. Harvey.*** *Institution of Electrical Engineers, Proceedings,* v. 106, pt. B, no. 26, Mar. 1959, p. 141-157.

7796* A New Method of Generating a Rotating Radiation Polar Diagram. Describes a new technique for overcoming the inherent difficulty of generating the type of radiation polar diagram required for operating Vorac in the desired 100 Mc/s region. Also describes how the new mtehod itself helps to improve the vertical elevational performance of a conventional Vor system. ***H. W. Hawkes.*** *Institution of Electrical Engineers, Proceedings,* v. 106, pt. B, no. 26, Mar. 1959, p. 158-169.

7797* Transistor Active Filters Using Twin-T Rejection Networks. Some basic circuits using a symmetrical twin-T network with *R* and *C* only in the feedback loop of a transistor amplifier are investigated. Results of measurements are given. Q-factors higher than 50 are obtained at a frequency of 600 c/s. ***A. E. Bachmann.*** *Institution of Electrical Engineers, Proceedings,* v. 106, pt. B, no. 26, Mar. 1959, p. 170-174.

7798* The Power Radiated by a Surface Wave Circulating Around a Cylindrical Surface. Describes calculations made for radiation arising when a surface wave circulates around a highly reactive supporting surface of cylindrical form. When the surface has a finite loss, there will be a particular radius of curvature for which the surface wave progresses for a limited distance without attenuation. ***H. E. M. Barlow.*** *Institution of Electrical Engineers, Proceedings,* v. 106, pt. B, no. 26, Mar. 1959, p. 180-185.

7799* Resistance of a Point Contact of a Semi-Conductor and Metal as a Function of Temperature. (*In Russian.*) O temperaturnoĭ zavisimosti soprotivleniia tochechnogo kontakta poluprovodnika i metalla. ***I. G. Nekrashevich and I. I. Petrovskiĭ.*** *Inzhenerno-Fizicheskii Zhurnal,* v. 2, no. 2, Feb. 1959, p. 86-89.

7800* Stored Charge Method of Transistor Base Transit Analysis. Base transit time is re-expressed in terms of stored charge per unit emitter current-terms which are conceptically much simpler to deal with. Using this viewpoint, the author readily shows that the base thickness is more important than the built-in field in determining base transit time. ***L. J. Varnerin.*** *I.R.E. Proceedings,* v. 47, Apr. 1959, p. 523-527.

7801* The Hall Effect Circulator—a Passive Transmission Device. An important addition to the nonreciprocal device family, a Hall effect circulator is described. ***W. J. Grubbs.*** *I.R.E. Proceedings,* v. 47, Apr. 1959, p. 528-535.

7802* Theory of the Crestatron: A Forward-Wave Amplifier. A theory is presented which satisfactorily explains the phenomenon of a gain occurring in a traveling-wave tube even though the voltage is so high that a growing wave cannot exist. A tube which utilizes the new mode of operation has been built and its performance described. ***J. E. Rowe.*** *I.R.E. Proceedings,* v. 47, Apr. 1959, p. 536-545.

7803* Theory and Experiments on Shot Noise in Silicon *P-N* Junction Diodes and Transistors. New theoretical expressions for the noise of silicon diodes and transistors are derived which are valid for silicon devices operating at low current densities. ***B. Schneider and M. J. O. Strutt.*** *I.R.E. Proceedings,* v. 47, Apr. 1959, p. 546-554.

7804* IRE Standards on Antennas and Waveguides: Waveguide and Waveguide Component Measurements, 1959. 59 IRE 2. S1. This standard provides very useful and important information on the proper methods of measuring some two dozen major quantities which characterize waveguides, waveguide components, and the associated electromagnetic fields. *I.R.E. Proceedings,* v. 47, Apr. 1959, p. 568-582.

7805 Recent Developments in Filter Theory. A review of the most important developments in filter theory during the postwar years. It is limited to filter theory in the narrowest sense, i.e., to the principles of the design of filters or filter groups meeting prescribed attenuation specifications as the problem arises. ***Vitold Belevitch.*** *IRE Transactions on Circuit Theory,* v. CT-5, no. 4, Dec. 1958, p. 236-252. (TK1 In6.6c Vis.)

7806 On the Realizability of Ladder Filters. A brief analysis is presented of the expansion of some input or output impedance in ladder form required in the design of an insertion loss filter. ***J. Meinguet and V. Belevitch.*** *IRE Transactions on Circuit Theory,* v. CT-5, no. 4, Dec. 1958, p. 253-255. (TK1 In6.6c Vis.)

7807 Snythesis of Band-Pass Ladder Network. Sufficient conditions for the possibility of constructing a nondissipative "band-pass" filter by means of a reactance ladder network are derived. The method of synthesis for two different kinds of ladder networks is presented in detail. ***Hitoshi Watanabe.*** *IRE Transactions on Circuit Theory,* v. CT-5, no. 4, Dec. 1958, p. 256-264. (TK1 In6.6c Vis.)

7808 On the Design of Filters by Synthesis. Computation methods are described which have proved to be the most rational ones in designing filters in accordance with widely different requirements. Explicit formulas for calculating the circuit-element values for several types of filters have been collected and further developed to make them generally applicable. ***R. Saal and E. Ulbrich.*** *IRE Transactions on Circuit Theory,* v. CT-5, no. 4, Dec. 1958, p. 284-327. (TK1 In6.6c Vis.)

7809 Transient Responses of Conventional Filters. Presents the computed impulse and step-function transient responses for some of the same types of filters. The transients have been computed in a straightforward manner by means of IBM Type 650 electronic digital computer. ***K. W. Henderson and W. H. Kautz.*** *IRE Transactions on Circuit Theory,* v. CT-5, no. 4, Dec. 1958, p. 333-347. (TK1 In6.6c Vis.)

7810 Theory of Magnetostrictive Delay Lines for Pulse and Continuous Wave Transmission. Presents an analytic formulation of delay line characteristics and derives equations that given analytic forms for the magnetostructive and inverse magnetostrictive effect. ***Roscoe C. Williams.*** *IRE Transactions on Ultrasonics Engineering, PGUE-7,* Feb. 1959, p. 16-38. (TK1 In6.6u Vis.)

7811 Semi-Conductor Grade Silicon Production. I.C.I. has brought into operation a large-scale development plant for the manufacture of high-quality silicon of semi-conductor grade. To date, much of the silicon used in Britain has come from America or France. Now I.C.I. will be able to satisfy the demand in Britain and at a later stage expects to enter the export field. *Metallurgia,* v. 59, Mar. 1959, p. 138.

7812* Masers and Parametric Amplifiers. ***Hubert Heffner.*** *Microwave Journal,* v. 2, Mar. 1959, p. 33-40.

7813* A Thermodynamic Analysis of Maser Systems. ***Harold I. Ewen.*** *Microwave Journal,* v. 2, Mar. 1959, p. 41-46.

7814* Principles of Microwave Interactions With Ionized Media. II. Electron-Cyclotron Resonance. Part I of this article explained the concept of plasma resonance and its relation to electromagnetic wave propagation. The purpose of this article is to discuss the propagation characteristics of such a wave in the presence of an ionized medium and a dc magnetic field. It will be shown that the addition of a dc magnetic field can greatly affect the propagation characteristics of a wave and thereby extend the number of applications in which a plasma may be used. This discussion is also applicable to ionospheric propagation when the effects of the earth's magnetic field are of importance. ***R. F. Whitmer.*** *Microwave Journal,* v. 2, Mar. 1959, p. 47-50.

7815 Noise. This book is concerned with noise in electronic devices, and reduces solutions to most noise problems to an analysis of simple networks. ***Aldert van der Ziel.*** 450 pp. 1954. Prentice-Hall, Inc., Englewood Cliffs, N. J. (TK6565.V3 V28n)

7816* Germanium-Silicon Alloy Junctions. When a germanium dot is heated on a silicon wafer, a molten alloy of the equilibrium compositions of Ge and Si is formed on the silicon wafer. As cooled with a temperature gradient, Si-enriched Ge-Si alloy is recrystallized on the adjacent pure Si, and the suc-

ceeding recrystallization produces gradually Ge-enriched Ge-Si alloy, which energy gap is abruptly modified from Si value to Ge-Si alloy's one and then gradually to Ge one. If alloy is made from Ge and Si doped with opposite type impurity of the segregation constants, k_1 and k_2, respectively, these impurities will be segregated during the successive solidification. ***Yasuo Matukura.*** *Physical Society of Japan, Journal,* v. 14, Mar. 1959, p. 374.

7817* Analytical Representation of the Time Function With Unlimited Spectrum. Analytical representation of a signal in the form of time function with unlimited spectrum is presented as a sum of time functions with limited spectrum. The coefficients of the series obtained are readily calculated from the approximating function values for discrete moments of time. (*In Russian.*) Analiticheskoe predstalenie funktsii vremeni s neogranichennym spektrom. ***I. T. Turbovich.*** *Radiotekhnika,* v. 14, no. 3, Mar. 1959, p. 22-27.

7818* Properties of the Symmetrical Delaying System With Three Channels. Symmetrical delaying systems with two rows of combs located between two parallel planes or in a rectangular waveguide are considered. An analysis is presented of the effect of the middle channel and of the periphery channels, formed by complementary openings between cells, on the dispersion characteristics coupling resistance, and the location of the electric field nodes. (*In Russian.*) Svoistva simmetrichoĭ zamedliaiushcheĭ sistemy s tremia kanalami. ***L. N. Deriugin and N. V. Trunova.*** *Radiotekhnika,* v. 14, no. 3, Mar. 1959, p. 28-39.

7819* Electrical Calculation of Operating Conditions for New Oscillator Triodes. A simple method is described for the calculation of plate circuits by means of derived correction coefficients. The method described is a universal one, suitable for all oscillators tubes independent of their plate or grid current characteristics. (*In Russian.*) Elektricheskiĭ raschet rezhimov novykh generatornykh triodov. ***V. A. Khatskelevich.*** *Radiotekhnika,* v. 14, no. 3, Mar. 1959, p. 58-68.

7820* Signals With the Maximal and Minimal Probabilities of Detection. Describes theoretical investigation of the forms of a signal which secure the maximal and minimal probabilities of their correct detection by means of an optimal receiver. The magnitudes of these probabilities are evaluated. (*In Russian.*) Signaly s maksimal'noĭ i minimal'noĭ veroiatnostiami obnaruzheniia. ***V. A. Kotel'nikov.*** *Radiotekhnika i Elektronika,* v. 4, no. 3, Mar. 1959, p. 354-358.

7821* Calculation of the Working Characteristics of Multi-Resonance Magnetrons. Analytical relationship is established for the mean value of the radial and tangential components of the electron velocity near anode at the cycloidal character of trajectories under high-frequency operational conditions of the magnetron. Approximate relationships are derived for volt-ampere characteristics, dynamic impedance, and electronic efficiency factor. (*In Russian.*) K raschetu rabochikh kharakteristik mnogorezonatornykh magnetronov. ***S. I. Bychkov.*** *Radiotekhnika i Elektronika,* v. 4, no. 3, Mar. 1959, p. 468-474.

7822* Detection in the Cathode Circuit of an Underexcited Reflex Klystron. Detection characteristics of the cathode circuit, the sensitivity and transmission coefficient, of the reflex klystron-amplifier are determined experiemntally. It was established that in these characteristics of cathode circuit detection the detector investigated is as good as the crystal detector. Possible mechanism of detection is theoretically considered. (*In Russian.*) Detektirovanie v katodnoĭ tsepi nedovozbuzhdennogo otrazhatel'nogo klistrona. ***S. A. Kornilov and G. N. Kazbekova.*** *Radiotekhnika i Elektronika,* v. 4, no. 3, Mar. 1959, p. 475-481.

7823* Nonlinear Theory of Two-Beam Electron Tube. I. Derivation and Analysis of Equations. Nonlinear equations for two-beam electron tube and the laws of conservation following from them are investigated. In the linear approximation these equations are reduced to the same form as Vlasov's kinetic equation. The dependence of the radius of action of repulsive forces between the beams is investigated. (*In Russian.*) Nelineĭnaia teoriia dvukhluchevoĭ elektronnoĭ lampy. I. Vyvod i issledovanie uravneniĭ. ***G. F. Filimonov.*** *Radiotechnika i Elektronika,* v. 4, no. 3, Mar. 1959, p. 489-499.

7824* Delay System of the "Finned" Type for Traveling-Wave Amplifiers. Describes a method of isolating the spatial field harmonic in the "Finned" delay system. The harmonic has small dispersion in a wide frequency range but is suppressed in the conventional type systems. Isolation can be effected by an insignificant shifting of the combs or by varying the fins' cross section. The calculation method proposed is simple and can be used for calculating traveling-wave amplifiers in the centimeter frequency range. (*In Russian.*) Zamedliaiushchaia sistema tipa "Vstrechnye shtyri" dlia usiliteleĭ s begushcheĭ volnoĭ. ***A. M. Beliantsev, A. V. Gaponov, and E. V. Zagriadskiy.*** *Radiotekhnika i Elektronika,* v. 4, no. 3, Mar. 1959, p. 505-516.

7825 Synthesis of Linear Communication Networks. Essentially a reference work designed to acquaint scientists and engineers with the fundamentals and practices of network design, covering the basic principles of circuit theories and providing aids for their practical design. ***Wilhelm Cauer.*** v. I-II. 2nd Ed. (Translated from the German by G. E. Knausenberger.) 866 pp. 1958. McGraw-Hill, New York. (QC641 C31t2tr)

7826 A New Method for Obtaining Maximum Gain From Yagi Antennas. A design procedure that provides maximum gain for a given array length is presented. ***H. W. Ehrenspeck and H. Poehler.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR-58-355,* Dec. 1958, 18 pp. (TK7800 Un3.12b Contin.)

7827 Tracking of a Moving Transmitter by the Doppler Effect. A report on the feasibility of tracking a moving transmitter by means of the Doppler shift in the received signal from the transmitter. The report shows that tracking is practicable only when sufficient a priori knowledge of the motion is at hand. When the moving transmitter is an artificial earth satellite, it can be tracked by Doppler measurements alone. A qualitative error analysis is given. ***Thomas Skinner.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR-58-364,* Dec. 1958, 20 pp. (TK7800 Un3.12b Contin.)

7828 The Propagation of Electromagnetic Waves in a Plasma (Ionosphere). Includes 73 literature references. ***B. N. Gershman, V. L. Ginzburg, and N. G. Denisov.*** *U. S. Atomic Energy Commission, AEC-tr-3493,* 1957, 83 pp. (Translated from *Uspekhi Fiz. Nauk,* v. 61, 1957, p. 561-612.) (UF767 Un3.1ae Contin.)

7829* The Western Union MLD-4 Microwave Relay System. A brief general description is presented of the equipment, design, and operation of the Western Union MLD-4 (medium bandwidth long distance 4000-mc) radio relay system. ***James J. Lenehan.*** *Western Union Technical Review,* v. 13, no. 2, Apr. 1959, p. 61-70.

7830* The Possibilities and Visuality Threshold in Infrared Rays. A brief theoretical investigation of the above problem from the viewpoint of the known relationships determining the quantum nature of visual perception, taking into account the processes of conversion and amplification occurring in infrared converters of the image. (*In Russian.*) Vozmozhnosti i porog videniia v infrakrasnykh luchakh. *Zarubezhnaia Radioelektronika,* 1959, no. 2, Feb., p. 28-30.

7831* Light Modulator for Photorecording of Radar Signals. The operating principle and performance characteristics of the light modulator for photographic recording of radar signals are briefly considered. (*In Russian.*) Svetovoĭ moduliator dlia fotozapisi radiolokatsionnyk signalov. *Zarubezhnaia Radioelektronika,* 1959, no. 2, Feb., p. 34-36.

See also: **7367** (beam-rider missile guidance system); **7700** (commutation circuits); **7706** (circuit reliability); **7712** (reliability and quality control symposium); **8008** (frequency standards); **8009** (radio interference instrumentation); **8010** (bolometer detectors); **8021** (complex electronic equipment reliability).

ENGINEERING ECONOMICS

7832 British Open Up to U. S. Analysts. The New York Society of Security Analysts members who visited London recently gained new insight into British corporations. Visitors from New York get more financial data, British papers complain, than companies give their fellow citizens. *Business Week*, no. 1546, Apr. 18, 1959, p. 68 + 2 pages.

7833* Computer Power: A Public Utility? The author suggests that computer capacities are of greater importance than computer faculties—that business in general is not considering or acknowledging this to be the case—that the military is, and business will sooner or later have to follow its lead—and last, that the legal, economic, historic, and social factors at work in the computer business may be leading us out of the area of free competition into that of the regulated public utility. ***Alan O. Mann.*** *Computers and Automation*, v. 8, Apr. 1959, p. 11-16.

7834* Pinpointing Soft Spots in Costs. Profit reports and cost breakdown give closer control of plant operations. ***Donald Hoodes.*** *Factory*, v. 117, Apr. 1959, p. 68-73.

7835 Marketing Is Common Sense. Marketing is essential to the continued growth and prosperity of your company. Its goals are to prevent losses to competitive processes and to soften the impact of business cycles. ***George K. Dreher.*** *Foundry*, v. 87, Apr. 1959, p. 100-109.

7836 Achieving Profitable Growth. The growth potential of the foundry industry and of the individual companies which compose it depends on its handling of market research, process research, and institutional advertising. ***Gregory M. Boni.*** *Foundry*, v. 87, Apr. 1959, p. 115-117.

7837 Functional Features in Product Strategy. Does management have an understanding of the role of product features in the over-all marketing plan? Actually, in spite of their continued use, surprisingly little attention has been devoted to refining the art and strategy of using these features in the marketing effort. ***John B. Stewart.*** *Harvard Business Review*, v. 37, no. 2, Mar.-Apr. 1959, p. 65-78.

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7839 Economic Indicators—How to Use Them in Business Forecasting. ***Henry M. Platt.*** *Management Review*, v. 48, Apr. 1959, p. 9 + 16 pages.

7840* Factors Affecting the Future of the Copper Industry. Discusses copper prices, production policies, fluctuation, consumption prospects, ore discovery rate, substitution prices, ore reserves, and capital costs. ***Ronald L. Prain.*** *Metals*, v. 29, no. 9, Mar. 1959, p. 7-9.

7841* A Proposal to Assist in Conserving Our Fossil Fuel Resources. Kuljian says we must put nuclear fuel at a competitive price level with fossil fuels to preserve our present coal resources. ***Harry A. Kuljian.*** *Power Engineering*, v. 63, Apr. 1959, p. 54-57.

7842 Industry Raises Ante in New Product Search. Survey by McGraw-Hill Dept. of Economics foresees increased R & D through 1962; new products stimulate plant, equipment, investment, and industrial capacity. *Product Engineering*, v .30, no. 16, Apr. 20, 1959, p. 23.

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7844* Making Capital Investment Pay. Wise investments in plant sites, buildings, and machine tools pay off in terms of productivity and profits. It may be more economical to build a new plant or install new machines than to keep obsolete or ineffiicent facilities in operation. Factors to be considered in long-range capital investment planning are evaluated. ***Carl M. Beach.*** *Tool Engineer*, v. 42, no. 4, Apr. 1959, p. 92-96.

7845* Savings Through Material Control. Cost control of purchased semifinished and raw materials can be a fertile field for savings. The author lists factors to watch and examines them in detail for various kinds of materials. In general, the more complex a product is, the smaller the influence of materials on total value. The manufacturing industries listed were chosen to illustrate industries where materials represent both high and low percentages of total product value. ***James B. Purdy.*** *Tool Engineer*, v. 42, no. 4, Apr. 1959, p. 97-101.

See also: **7447** (survey of ethylene chemicals market through 1964); **7907** (world crude-oil reserves); **7917** (economics of long-range open-pit mining); **7942** (U.S.S.R. coal industry); **8498** (welding economics); **8500** (welding production management).

FLUID MECHANICS

7846* Viscosity Stability of Hydraulic Fluids. Causes of changes in viscosity, and their effect on the systems and methods of measurement. ***N. W. Furby and R. I. Stirton.*** *Applied Hydraulics & Pneumatics*, v. 12, Apr. 1959, p. 84 + 3 pages.

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7848* Theoretical Derivation of Tangential Velocity Profiles in a Flat Vortex Chamber-Influence of Turbulence and Wall Friction. ***K. Rietema and H. J. Krajenbrink.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods*, v. 8, nos. 2-3, 1959, p. 177-197.

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7850* The Experimental Data Generalization on the Critical Heat Fluxes in Forced Flowing of Subheated Water. Shows that a criterion equation submitted to a previous study can be simplified for pressures of 1 to 15 atm. (*In Russian.*) K obobshcheniiu opytnykh dannykh po kriticheskim teplovym nagruzkam pri vynuzhdennom dvizhenii nedogretoĭ vody. ***B. A. Zenkevich.*** *Atomnaia Energiia*, v. 6, no. 2, Feb. 1959, p. 169-173.

7851 Heat Transfer and Pressure Drop. Charts to evaluate quickly shell-side heat transfer coefficients and pressure drops in transverse finned shell-and-tube heat exchangers. ***Ning Hsing Chen.*** *Chemical Engineering*, v. 66, Apr. 6, 1959, p. 141-144.

7852 Introduction to the Theory of Compressible Flow. Gives a theoretical introduction to the fluid dynamics of a compressible fluid. Treats the basic assumptions and the formulation of the theory of compressible flow, as well as methods of solving these problems. ***Shih-I Pai.*** 385 pp. 1959. D. Van Nostrand Company, Inc., Princeton, New Jersey. (QA930 P15i)

7853* The Effect of Organic Additives on the Surface Tension of the System: Water-Sodium Laurate and Butanol-1. The surface tension decreases with the increases in the concentration of the acids, owing to the incorporation of the acids in the micelles. The increase in surface tension in presence of phenols is probably due to the formation of a sheath of solvated molecules of phenols round the micelle. ***A. N. Bose and Virendra K. Dixit.*** *Kolloid-Zeitschrift*, v. 162, no. 2, Feb. 1959, p. 114-115.

7854* Fluidization Makes Solids Flow. This technique—pioneered by the petrolem industry—speeds up a wide range of processes, such as the carbonization of coal and the drying

of textiles. It also improves the physical properties of man-made fibers. Other uses are being studied. ***Israel Berkovitch.*** *New Scientist*, v. 5, Apr. 2, 1959, p. 738-739.

7855* The Effect of Pressure Fluctuations in a Gas Flow Upon Convective Heat Exchange. The results of theoretical and experimental studies. (*In Russian.*) Vliianie pul'satsiĭ davleniia v potoke gaza na konvektivnyĭ teploobmen. ***S. I. Kosterin, I. A. Kozhinov, and A. I. Leontiev.*** *Teploenergetika*, v. 6, no. 3, Mar. 1959, p. 66-72.

7856 Flow Through Microporous Media Theory of Flow Phenomena. A theoretical treatment of the flow mechanisms involved in laminar flow, through slip flow and transition flow to Knudsen flow, presenting a unified picture of interrelations and of characteristic features for flow through individual capillaries and through microporous media, respectively. Theoretical treatises are also presented on adsorbate-adsorbent interaction, and mechanisms of fluid motion of the adsorbed phase through the microporous medium. ***Lenard O. Rutz and Karl Kammermeyer.*** *U. S. Atomic Energy Commission, AECU*-3921, Dec. 1, 1958, 98 pp. (UF767 U3au Contin.)

7857 Wall Turbulence. Equations governing turbulent flow along a wall. Reynolds stresses. Equations pertaining to the correlation functions. Equations expressing the dissipation of energy and the dissipation of vorticity. Flow in two-dimensional ducts having constant cross-section. The boundary layer on a flat plat experiencing no pressure gradient. The boundary layer on a constraining wall subjected to a pressure gradient. Attempts to arrive at a rational theory of wall turbulence. ***Carlo Ferrari.*** *U. S. National Aeronautics and Space Administration, NASA Republication, NASA RE* 2-8-59W, Mar. 1959, 133 pp. (TL570 Un3tm Vis.)

See also: **7938** (barotropic development of eddies).

FOOD TECHNOLOGY

7858* Application of Nuclear Magnetic Resonance in Meats Research. Concludes that instruments of greater scope and resolution than used in the study might play a significant role in revealing important physical changes and inter-relationships taking place in meat structure. ***Robert K. Steffa, Clarence A. Blanck, Eugen Wierbicki, and Glenn E. Cooper.*** *Food Research*, v. 24, no. 2, Mar.-Apr. 1959, p. 210-217.

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FUELS AND COMBUSTION

7861 Some Thermal Stress Design Data for Rocket Grains. Design data for thermal stresses are presented for the particular case of a steady-state temperature difference across the grain, or for a specified heat flux. Supplements an earlier paper. ***M. L. Williams.*** *ARS Journal*, v. 29, Apr. 1959, p. 260-267.

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7868* Recuperation of Heat in Industry. Use of low-gradient heat. Combined use of heat for power production and manufacturing processes. (*In French.*) La récupération de chaleur dans l'industrie. ***J. Fafournoux.*** *Chaleur & Industrie*, 1959, no. 403, Feb., p. 47-56.

7869 Designing for Low-Cost Coal Preparation. Design innovations in coal-cleaning plants reflect changing requirements within the fuel market, particularly in the preparation of steam coals. ***Nelson L. Davis.*** *Coal Age*, v. 64, Apr. 1959, p. 126-128.

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7871* Excess Radical Concentrations and the Disappearance of Carbon Monoxide in Flame Gases From Some Lean Flames. Both the concentrations of hydroxyl and the intensities of the CO oxygen continuum have been measured in a series of lean H-CO-air, H-CO_2-air, and ethylene-air flames burning on cooled porous metal burners. Shows that above 1,500 K the relationship of emitted intensity to [OH] is consistent with a known scheme. ***W. E. Kaskan.*** *Combustion and Flame*, v. 3, no. 1, Mar. 1959, p. 49-60.

7872* Theory of Flame Propagation. Previous work on steady state propagation of flat flames is reviewed and various mathematical techniques are contrasted. The effects of varying parameters, heat loss, and chain reactions are considered. Limits of validity are given. ***Y. B. Zeldovich and G. I. Barenblatt.*** *Combustion and Flame*, v. 3, no. 1, Mar. 1959, p. 61-74.

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ing of fuel. ***A. C. Syrett.*** *Fuel Efficiency*, v. 7, Mar. 1959, p. 33-34.

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7878 Irradiation Performance of Highly Enriched Fuel. The irradiation data on Zr-U alloys are compared with similar data on other enriched fuel systems. A specific comparison is made with the stainless steel–UO_2 dispersion fuel system. ***C. E. Lacy and E. A. Leary.*** *U. S. Atomic Energy Commission, KAPL-1952*, June 20, 1958, 18 pp. (UF767 Un3.1ka Contin.)

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7880 Theoretical Combustion Performance of Several High-Energy Fuels for Ramjet Engines. An analytical evaluation of the theoretical ramjet performance of Mg, Mg–octene-1 slurries, Al, Al–octene-1 slurries, B, B–octene-1 slurries, C, hydrogen, α-methyl-naphthalene, diborane, pentaborane, and octene-1. ***Leonard K. Tower, Roland Breitwieser, and Benson E. Gammon.*** *U. S. National Advisory Committee for Aeronautics, Report* 1362, 18 pp. (TL521 Un3r Vis.)

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See also: **7414** (petroleum fuel technology); **7454** (regulation of liquid methane transport); **7942** (U.S.S.R. coal industry).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

7882* The Settling of Rhodochrosite From Chloride, Sulphate and Bicarbonate Manganese Solutions. Experimental study of physical-chemical settling conditions of $MnCO_3$ from chloride and sulfate solutions of various concentrations at interaction with $NaHCO_3$ solutions, followed by an investigation of deposits obtained under defined equilibrium conditions. Study of the crystallization process of $MnCO_3$ from Mn bicarbonate solutions with an elimination of various amounts of carbonic acid from these solutions. (*In Russian.*) Osazhdenie rodokhrozita iz khloridnykh sul'fatnykh i bikarbonatnykh rastvorov margantsa. ***L. P. Listova.*** *Akademiia Nauk SSSR, Doklady*, v. 124, no. 1, Jan.-Feb. 1959, p. 183-186.

7883* On the Source Zone of the Crust, Magmatogene Crown of the Earth, Areals of Magmatism and Structural Associations of Intrusives. Some hypothetical considerations on the regional structural units of magnetism based on an analysis of well-known facts. Development of the idea of the existence in the basis of the earth's crust of a special "source zone" controlling its magmatic and tectonic movements. (*In Russian.*) Ob "ochagovoĭ zone" zemnoĭ kory, "magmatogennoĭ korone" zemli, "arealakh magmatizma" i "structurnykh assotsiatsiiakh intruzivov". ***G. L. Pospelov.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Geologicheskaia*, 1959, no. 3, Mar., p. 19-35.

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7885* Lithologic Analysis of Sedimentary Rocks. Rocks may be described in sample cuttings to rock type, color, grain or crystal size, cement or matrix, impurities, porosity, stain, luster, fossils, associated material, and subordinate features. Rocks are divided into noncarbonate and carbonate clastic types. Evaporites compose a third major rock type. Several simple tests for determining mineralogy and oil shows can be made by a stratigrapher. ***Robert P. McNeal.*** *American Association of Petroleum Geologists, Bulletin*, v. 43, Apr. 1959, p. 854-879.

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7888* Synthesis of Bastnaesite. Synthesis of the compositions CeFCO and (Ce, La)FCO_3 are reported. Identification of the products was by X-ray powder diffraction patterns. ***George J. Jansen, George B. Magin, Jr., and Betsy Levin.*** *American Mineralogist*, v. 44, nos. 1-2, Jan.-Feb. 1959, p. 180-181.

7889* Geophysics and Continental Growth. An analysis of the principal features of the Earth with the thought that its main internal movements may be relatively simple in character, that they are similar now to what they were in the past, that they should be subject to known physical laws and that it may be possible to discern them if we consider all the evidence now available. ***J. Tuzo Wilson.*** *American Scientist*, v. 47, no. 1, Mar. 1959, p. 1-24.

7890* The Dissipation of Gas From Planetary Atmospheres. II. The Total Velocity Dissipation of Gas From a Planetary Atmosphere. The Problem of Terrestrial Helium. A general expression has been found for the velocity of gas dissipation from a planetary atmosphere. The velocity of gas dissipation and also the thickness and position of the layer, from which the dissipating process is most effective, were calculated for cases of a single component atmosphere, and an atmosphere composed of a heavy gas with a small admixture of a light gas. (*In Russian.*) Dissipatsiia gaza iz atmosfer planet. II. Polnaia skorost' dissipatsii gaza iz atmosfery planety. Problema zemnogo geliia. ***E. K. Biutner.*** *Astronomicheskiĭ Zhurnal*, v. 36, no. 1, Jan.-Feb. 1959, p. 89-99.

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7896 High Quality Strip and Auger Coal Meets Today's Market Requirements. Operation and organization of a West Virginia mine. *Coal Age,* v. 64, Apr. 1959, p. 84-89.

7897* Studies of Silurian (Gotlandian) Algae. A review of Silurian (Gotlandian) algae; new Silurian dasycladaceae from the Southwestern United States; some Silurian calcareous algae from Northern California and Japan. ***J. Harlan Johnson, Kenji Konishi, and Richard Rezak.*** *Colorado School of Mines, Quarterly,* v. 54, no. 1, Jan. 1959, 173 pp.

7898* Maxima in the Vertical Distribution of Particles in the Sea. Discussion and interpretation of this phenomenon. ***N. G. Jerlov.*** *Deep-Sea Research,* v. 5, no. 3, Mar. 1959, p. 173-184.

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7900* New Tools, Methods Speed Spread of Air/Gas Drilling. A relatively new technique still has its drawbacks, but they are crumpling under steady attacks in the laboratory, the factory, and the field. *Drilling,* v. 20, Apr. 1959, p. 72-74.

7901* Some Applications of Thermochemical Data to Problems of Ore Deposits. I. Stability Relations Among the Oxides, Sulfides, Sulfates and Carbonates of Ore and Gangue Metals. It is shown that the temperature and the fugacity (f) of O, S, and CO_2 in ore forming fluids at the time of deposition of the vein minerals largely control the mineralogy of ore deposits. fs_2–fo_2–T diagrams showing the stability fields of sulfides, oxides and sulfates of 19 metals are developed as well as fs_2–fo_2–fCO_2 diagrams showing the stability of these compounds and of carbonates of the respective elements. ***Heinrich D. Holland.*** *Economic Geology,* v. 54, no. 2, Mar.-Apr. 1959, p. 184-233.

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7904* Distribution of Gallium in Rocks of the Soviet Union. (*In Russian.*) Raspredelenie galliia v gornykh porodakh sovetskogo soiuza. ***L. A. Borisenok.*** *Geokhimiia,* 1959, no. 1, p. 46-59.

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7908* Radiation Observations With Satellite 1958 ϵ. A preliminary account is given of the radiation observations made with Satellite 1958 ϵ. The earlier discovery of the great radiation belt around the earth with Satellites 1958 α and 1958 γ has been confirmed and greatly extended with an apparatus of much greater dynamic range and discrimination. It appears likely that many important geophysical phenomena are intimately related to the reservoir of charged particles found to be trapped in the outer reaches of the earth's magnetic field. ***James A. Van Allen, Carl E. McIlwain, and George H. Ludwig.*** *Journal of Geophysical Research,* v. 64, no. 3, Mar. 1959, p. 271-286.

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7910* An Analysis of Large-Scale Flooding in the Fractured Spraberry Trend Area Reservoir. A single five-spot pilot water flood was initiated in the west central portion of the Spraberry Trend Area reservoir. A combination analytical and numerical method employing high-speed computing equipment was utilized to analyze results of this pilot flood. Information obtained was then used to develop a flooding program for a 40-section area in the western portion of the field. ***E. C. Barfield, J. K. Jordan, and W. D. Moore.*** *Journal of Petroleum Technology,* v. 11, Apr. 1959, p. 15-19.

7911* Laboratory Study Indicates Significant Effect of Pressure on Resistivity of Reservoir Rock. Shows from laboratory tests that theoretical reservoir stress increases resistivity in varying amounts, depending upon depth (or stress) of formation, porosity, texture of rock, and degree of water saturation. ***C. R. Glanville.*** *Journal of Petroleum Technology,* v. 11, Apr. 1959, p. 20-26.

7912* The Alteration of Rock Properties by Percussion Sidewall Coring. Presents existing field and laboratory data that were available. Several examples of comparative core analysis data obtained from various fields are shown. The results of this investigation throw more light on the possible disturbed conditions of percussion sidewall cores. ***G. M. Webster and G. E. Dawsongrove.*** *Journal of Petroleum Technology,* v. 11, Apr. 1959, p. 59-62.

7913* Laboratory Investigation of the Water-Driven Carbon Dioxide Process for Oil Recovery. Water-propelled banks of CO_2 recovered both high- and low-viscosity crude oil substantially in excess of that recovered by water flood in linear flow model experiments. The increase is explained by oil swelling and viscosity reduction. Additional oil was recovered by solution gas drive at the end of the CO_2 floods when the model

systems were depressured. ***D. M. Beeson and G. D. Ortloff.*** *Journal of Petroleum Technology*, v. 11, Apr. 1959, p. 63-66.

7914* The Russian Approach to Soil Classification and Its Recent Development. ***J. J. Basinski.*** *Journal of Soil Science*, v. 10, no. 1, Mar. 1959, p. 14-26.

7915* Determination of the Minimum Temperature in Antarctic Regions. This temperature is evaluated from −91 to −92 C. (*In Russian.*) Opredelenie minimal'noĭ temperatury v Antarktike. ***Ye. M. Dobryshan.*** *Meteorologiia i Gidrologiia*, 1959, no. 1, Jan., p. 21-25.

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7919* The Gyratory Ball Mill. Design, principle of operation, and performance. ***A. W. Fahrenwald.*** *Mining Congress Journal*, v. 45, Apr. 1959, p. 94-97.

7920* Radiation Hazards in Uranium Mining. Radiation studies in U mines show that the greatest hazard is probably produced by Rn daughters, and that practically all mines must have mechanical ventilation to reduce the concentration of these elements to the suggested working level. In most mines, if the Rn daughters are controlled, other airborne radioactive dusts will also be controlled. ***Duncan A. Holaday.*** *Mining Congress Journal*, v. 45, Apr. 1959, p. 104-106.

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7926* The Role of the Lithologic Factor in Formation of Gas-Oil Deposits. Study of the gas-oil deposits of the Lower Omra field showed that their nature and structure approaches closest to the type of the third sub-group of the classification of I. O. Brod. ***S. I. Kachkin and V. S. Sobolev.*** *Petroleum Geology*, v. 2, no. 6-A, 1958, p. 528-533. (Translated from Russian.)

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7929 Use High-Calcium Drilling Fluid to Stop Shale Hydration. Hydration of shaly materials causes trouble during drilling by aggravating hole enlargement, formation sloughing, and excess mud viscosity which can permanently reduce well productivity. ***P. H. Monaghan and J. L. Gidley.*** *Oil and Gas Journal*, v. 57, no. 16, Apr. 13, 1959, p. 100-103.

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7931* A Method of Analysis for Long-Wave Phenomena in the Ocean, Using Electronic Network Models. I. The Earth's Rotation Ignored. Describes an analogue method which uses a variable electric network to treat long-wave phenomena and their applications. A wide range of conditions can be covered by making only minor variations in the circuit. The author has tried to treat as wide a range of problems as possible by using only simple and small-scale equipment. ***S. Ishiguro.*** *Royal Society of London, Philosophical Transactions*, v. 251, Ser. A. Mathematical and Physical Sciences, no. 996, Mar. 19, 1959, p. 303-340.

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7936* The Application of Square Wave Polarography to the Monitoring of the Uranium Content of Uranium Plant Solutions. Experimental work in the laboratory has shown that a high degree of accuracy is obtainable with the above when used for determining the U content of plant solutions. Experimental work is already under way for the fabrication of a static solution sampling unit. ***Eric Goldblatt.*** *South African Institute of Mining and Metallurgy, Journal*, v. 59, no. 7, Feb. 1959, p. 369-382.

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7938 A Numerical Investigation of the Barotropic Development of Eddies. Deals with the formation of eddies in a straight parallel or zonal flow and with the subsequent modification of the flow profile. The fluid is taken to be homogeneous and inviscid. Numerical analogues for the physical equations are developed in detail and are analyzed. ***Manfred M. Holl.***

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7940 Geology and Hydrology for Disposal of Radioactive Wastes to Ground at the Savannah River Plant. A general method is outlined for determining the proper placement of a seepage basin or burial ground area and for evaluating and monitoring its performance. ***Stanley O. Reichert.*** *U. S. Atomic Energy Commission, DP-*341, Dec. 1958, 24 pp. (UF767 Un3.1dp Contin.)

7941 Geologic Investigations of Radioactive Deposits. Semiannual progress reports for Dec. 1, 1956 to May 31, 1957, and for Dec. 1, 1957 to May 31, 1958. *U. S. Atomic Energy Commission, TEI-*690, Books 1-2, July 1957, 571 pp. *TEI-*740, June 1958, 320 pp. (UF767 Un3t Contin.)

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7945* New Exploration Technique Shows Promising Results. Useful exploratory information is obtained by detection and interpretation of low energy gamma rays emitted from the surface. ***R. Y. Walker and Samuel R. Litzenberg, Jr.*** *World Oil,* v. 148, Apr. 1959, p. 134-137.

See also: **7483** (alumina from anorthosite); **7490** (mud pump economics); **7962** (tidal energy recovery).

GRAPHIC ARTS

7946* Magnetic Inks for Electronic Sensing. Printing inks with applications in complex electronic equipment for automatic sorting of printed materials, such as bank checks, postage stamps, and business forms. ***C. B. Blake and L. F. Miller.*** *American Pressman,* v. 69, no. 4, Apr. 1959, p. 12 + 2 pages.

7947 Film Stability Tests. Tests by which some idea of film life can be determined. *Industrial Photography,* v. 8, Apr. 1959, p. 32 + 2 pages.

7948 105 Mm. Used where second original has to be able to do everything the original could do, 105 mm will even turn out reproductions better than original itself. ***Ernest P. Taubes.*** *Industrial Photography,* v. 8, Apr. 1959, p. 36 + 1 page.

7949 Measuring Motion With High-Speed Movies. Details on what available cameras can do, getting data off the film, and determining the accuracy of the data. ***William G. Hyzer.*** *Machine Design,* v. 31, Apr. 2, 1959, p. 102-108.

7950* Some Notes on the Displacement of Photographic Images Caused by Tilt and Relief. Formulas are developed to express the relationships between angles measured about the principal-point, isocenter, and nadir-point in the plane of a tilted photograph and corresponding angles on the ground. ***Arthur H. Faulds.*** *Photogrammetric Engineering,* v. 25, no. 1, Mar. 1959, p. 110-115.

7951* Differential Elevation by Adaptation of the Parallax-Correction Graph to Parallax Mesurements on Aerial Photographs. A method which will assist the photogrammetrist in attaining greater accuracy in determining elevations. ***H. M. Chittenden.*** *Photogrammetric Engineering,* v. 25, no. 1, Mar. 1959, p. 144-151.

7952* Moving Picture Methods in Scientific Investigations. Summary of the proceedings of the XII Congress of the International Association of Scientific Moving Pictures. Uses of moving pictures in astronomy and cosmonautics, filming of biological processes, filming using improved types of microscopes, combination of X-ray cinematography with television and other essential problems. (*In Russian.*) Metody nauchnogo kinoissledovaniia. ***I. V. Sokolov.*** *Priroda,* v. 48, no. 3, Mar. 1959, p. 55-60.

7953 How to Clean Electrotypes Before Chromium Plating. Electrotypes with a chromium-plated wear surface are more economical for printers who must make a long press run. The chromium surface increases the press life of a nickel-faced electrotype from a maximum of 750,000 impressions without the chromium to as much as 4,000,000 impressions with the final chromium plate. The additional number of impressions which can be gained by using chromium plated electrotypes instead of the plain copper electrotypes, plus the savings of approximately 75% of the press down time required to replace worn plates, make chromium plating an economic necessity on long press runs. ***T. E. Wiemyer.*** *Products Finishing,* v. 23, no. 7, Apr. 1959, p. 52-54.

7954* Change of the Contrast of Photographic Layers by Optical Sensitization. Investigation of the increase of the γ value by optical sensitization of photographic emulsions. (*In German.*) Über die Veränderung der Gradation photographischer Schicten durch die optische Sensibilisierung. ***H. Zwicky.*** *Zeitschrift für Wissenschaftliche Photographie, Photophysik und Photochemie,* v. 53, nos. 4-6, Feb. 1959, p. 68-74.

HEAT POWER

7955* "Power Package" for Electra. First all-American turbojet built around proven engine; prop designed to specific airframe and engine needs. ***John P. Kushnerick.*** *Aircraft and Missiles Manufacturing,* v. 2, Apr. 1959, p. 14-17.

7956* Vibration Testing Jet Engines. Shaking gas turbines and components with small electromagnets offers versatility, accuracy, and economy. ***George E. Billman.*** *Aircraft and Missiles Manufacturing,* v. 2, Apr. 1959, p. 26-29.

7957* The Control System of a 225,000-Kw Double-Automatic Extraction Steam Turbine and Related Reducing Stations. The three variables which must be controlled on a double-automatic extraction turbine—speed (or power output), and the two process-header pressures—by controlling the flow of steam at different pressure levels have been on many turbines. However, designs for 50,000-kw turbines were not suitable for a turbine nearly five times as large, and a completely new control system was required. ***M. A. Eggenberger and P. G. Ipsen.*** *ASME, Transactions, Series A, Journal of Engineering for Power,* v. 81, no. 2, Apr. 1959, p. 111-122.

7958* Development of a Smooth Running, Double-Spool, Gas-Turbine Rotor System. Bearing stability difficulties in a 10,000-kw gas-turbine plant comprising three independent shafts are discussed. Design changes which finally solved this instability problem are outlined. Dynamic shaft and bearing performance which explains the experimental findings. ***J. R. Schnittger.*** *ASME, Transactions, Series A, Journal of Engineering for Power,* v. 81, no. 2, Apr. 1959, p. 151-160.

7959 A Monopropellant Air-Turborocket. Use of such engines, with characteristics which offer a considerable choice to the designer, could mean smaller and lighter space vehicles. ***James W. Mullen, II.*** *Astronautics*, v. 4, Apr. 1959, pt. 1, p. 36 + 2 pages.

7960 A Future for Hypersonic Ramjets. Missile, transport aircraft, and recoverable space vehicle booster applications appear practical within a decade, providing necessary research is done on hypersonic inlets, materials, and real-gas kinetics. ***Gordon L. Dugger.*** *Astronoutics*, v. 4, Apr. 1959, pt. 1, p. 38 + 5 pages.

7961* Steam Turbines for Auxiliary Machinery. The steam turbine is the ideal variable speed prime-mover for auxiliary machinery operating in conjunction with, or in relation to, steam generating plant. ***James Ross.*** *Australasian Engineer*, 1959, Feb. 7, p. 60-66.

7962* Harnessing the Tides. Problems of tide-produced hydroelectric power. ***Keith F. Bean.*** *Australasian Engineer*, 1959, Feb. 7, p. 76-77.

7963* The Surface of the Heat Exchanger and of the Heater With Gas Turbines. With a given quantity of heat transferred to the working medium in the heater and heat exchanger of a gas turbine process, the heater and heat exchanger surfaces can be selected so that first costs reach a minimum value. Consideration of the fuel cost results in a somewhat larger surface of the heat exchanger. (*In German.*) Die Fläche des Wärmetauschers und des Erhitzers bei Gasturbinen. ***Nebojša Gašparović.*** *Brennstoff-Warme-Kraft*, v. 11, Mar. 1959, p. 123-125.

7964* Assessment of Combustion Chambers of Gas Turbines Based on the Energy. Different definitions of efficiencies are given issuing from; the balance of entering and leaving quantities of the flowing media, the comparison of the final states of the working medium, and the comparison of its initial and final states. Presents an efficiency considering alterations of the point of reference. (*In German.*) Beurteilung von Brennkammern für Gasturbinen mit Hilfe der technischen Arbeitsfähigkeit. ***H. Kruppe.*** *Brennstoff-Wärme-Kraft*, v. 11, Mar. 1959, p. 135-136.

7965* Gas Piston Engines. A general review. (*In French.*) Les moteurs à gaz à pistons. ***G. Costes.*** *Chaleur & Industrie*, 1959, no. 403, Feb., p. 29-37.

7966* Steam Power Plant Clinic. VII. Discussion of various boiler feed pump problems in question and answer form. ***Igor J. Karassik.*** *Combustion*, v. 30, no. 9, Mar. 1959, p. 39-42.

7967* First European Supercritical Power Plant: Design and Experience. I. *G. Noetzlin and A. Engl.* *Combustion*, v. 30, no. 9, Mar. 1959, p. 43-47.

7968* Uninterrupted Power Unit. Allis-Chalmers introduces a 10 KW "no-break" auxiliary generator set incorporating diesel engine and synduction motor: unit is designed for applications where continuous power must be maintained. *Diesel and Gas Turbine Progress*, v. 25, Apr. 1959, p. 34-35.

7969* Industrial and Central Station Gas Turbines. A gas turbine progress report. ***R. Tom Sawyer.*** *Diesel and Gas Turbine Progress*, v. 25, Apr. 1959, p. 48-49.

7970* 1959 Engine Specifications. Diesel. Dual-Fuel. Natural Gas. Data on engines manufactured by American Diesel engine builders and on foreign Diesel engines sold in this country. *Diesel Power*, v. 37, Apr. 1959, p. S1-S16.

7971* Volvo-Penta, Bolinder. The Swedish Volvo engines, their construction highlights, and operation. *Diesel Power*, v. 37, Apr. 1959, p. 65 + 2 pages.

7972* Philo Supercritical Unit Passes Second Year. Two years of operation and maintenance experience of prototype unit gives direction to study of problems that may occur on supercritical-pressure units. ***T. T. Frankenberg, A. G. Lloyd, and E. B. Morris.*** *Electric Light and Power*, v. 37, no. 8, Apr. 15, 1959, p. 72 + 6 pages.

7973 A New Diagram for Steam Turbines With Multiple Tapping and Intermediate Superheating. (*In German.*) Wärmediagram für Dampfturbinen mit mehrfacher Anzapfung und Zwischenüberhitzung. ***W. Schüller.*** *Energietechnik*, v. 9, no. 2, Feb. 1959, p. 59-65.

7974 Energy for Man. Windmills to nuclear power. ***Hans Thirring.*** 409 pp. 1958. Indiana University Press, Bloomington. (TJ147 T34e)

7975* Air Engines. I. The different types of air engines are classified into three groups: open cycle internal combustion, open cycle external combustion and closed cycle engines. Principles of operation are explained and typical examples of each are given. Engines ranging from a small toy motor to a monstrosity with four 14 ft. dia. cylinders, running at 9 r.p.m., are described. Recent new developments are dealt with and some interesting proposals for future applications of these basic scientific principles are made. ***T. Finkelstein.*** *Engineer*, v. 207, Mar. 27, 1959, p. 492-497.

7976* Air Engines. II. A comprehensive set of illustrations and descriptions of air engines. Recent new developments are dealt with and some interesting proposals for future applications of these basic scientific principles are made. ***T. Finkelstein.*** *Engineer*, v. 207, Apr. 3, 1959, p. 522-527.

7977 Free-Piston Engines Afloat. Power units consisting of free-piston gasifiers and exhaust gas turbines offer several advantages for ship's propulsion. Machinery of this type fitted to the British ore carrier "Morar" is described. *Engineering*, v. 187, Mar. 13, 1958, p. 349-350.

7978 Performance of Jenbach Two-Stroke Oil Engines. Comparison of Four-Cylinder and Single-Cylinder Types. Two over-all comparisons were made of lubricating oil and fuel consumption, and gave, respectively, for the lubricant, 0.7 and 0.5% of the combustible; the higher value is associated generally with higher speeds. ***S. J. Davies.*** *Engineering*, v. 187, Mar. 27, 1959, p. 404-406.

7979* Gas Engine Operation as Seen With an Electronic Analyzer. Industrial Engine Analyzer developed by the Sperry Gyroscope Company. ***M. G. Wallington.*** *Gas Age*, v. 123, Apr. 16, 1959, p. 38-40.

7980* Increased Output From Free-Piston Engines. Examination of various possibilities to increase the power per unit of free-piston gasifiers of the GS-34 type. ***R. Huber.*** *Gas and Oil Power*, v. 54, Mar. 1959, p. 83-86.

7981 An Experimental Opposed-Piston Diesel Engine. The background to the development of an experimental two-stroke Diesel engine at the Institute is discussed. The technical features of the engine are briefly outlined. ***N. N. Narayan Rao.*** *Madras Institute of Technology, Journal*, no. 6, Dec. 1957, p. 75-88.

7982* Free Piston Gasifiers. Explains the working principles of free piston gasifier units, their advantages, and gives details regarding General Motors Hyprex, the Baldwin-Lima-Hamilton DL gasifier and the Sigma GS 34 gasifier. ***R. Gopalkrishnan.*** *Madras Institute of Technology, Journal*, no. 6, Dec. 1957, p. 115-128.

7983 Powerhouse in a Capsule. Unconventional sources of power that generate electricity without moving parts may be the answer to tomorrow's energy-generation needs. ***Edward F. Mayer.*** *Machine Design*, v. 31, Apr. 2, 1959, p. 22-26.

7984* A Rationalised Line of Diesel Engines. Rationalization in the design and production of diesel engines being built by Rolls-Royce Ltd. *Machinery Lloyd (Overseas Ed.)*, v. 31, no. 7, Mar. 28, 1959, p. 69-71.

7985* Gas Turbine Locomotives. In Scotland, Canada, and the United States locomotive designers and builders are engaged in developing a gas turbine engine which can burn pulverized coal instead of oil. The Scottish design is nearest to realization. ***J. N. Westwood.*** *New Scientist*, v. 5, Mar. 19, 1959, p. 641-643.

7986* Higher-Powered "Sixes". Dorman normally aspirated and turbocharged LB series of oil engines up to 200 b.h.p. *Oil Engine and Gas Turbine*, v. 26, Mar. 1959, p. 413-414.

7987 Power-Recovery Gas Turbines for Fluid-Bed Processes. A 4,000-hour test has proved feasibility of a gas turbine in several applications. Gases containing fluid catalyst can be used in the turbine after passing through a primary separator where most catalyst particles are removed. ***J. C. Dygert.*** *Oil and Gas Journal*, v. 57, no. 17, Apr. 20, 1959, p. 94-100.

7988* Gas-Fired Turbine Is Working Out. The first gas-fired turbine to make an appearance on a products line. The 1,150-hp machine uses natural gas fuel and the pump it drives can handle as much as 4,200 barrels of products per hour. This turbine may prove popular on other products lines. *Pipe Line Industry*, v. 10, Apr. 1959, p. 45-47.

7989* What You Should Know About Resonant Speeds. ***W. J. Caruso.*** *Power*, v. 103, Apr. 1959, p. 76-78.

7990* Computation of the Real Cycle of Four-Stroke Engines With Compression Ignition and Direct Injection. ***G. Bărănescu.*** *Revue d'Électrotechnique et d'Énergétique*, v. 3, no. 2, 1958, p. 307-331.

7991 First Airborne Atomic Engines Will Be Nuclear-Chemical Hybrids. Analysis of possible configurations for engines using nuclear reactor as energy source, covering ramjets and turbojets and supplementary heating of air flow past the reactor. Diagrams show likely arrangement of major items. Temperatures, compression ratios, engine sizes, and thrust levels are given for hypothetical designs. ***G. N. Nesterenko, A. I. Sobolev, and Yu N. Sushkov.*** *Space/Aeronautics*, v. 31, no. 4, Apr. 1959, p. 47-49.

7992* Some Problems in Thermal Schemes for Super-High Steam Parameter Block Installations. Considers problems of the selection of the feed water temperature, connection scheme for feed water pump turbine drive, and vacuum in condenser. (*In Russian.*) Nekotorye voprosy teplovykh skhem blokov na sverkhvysokie parametry para. ***A. E. Gel'tman.*** *Teploenergetika*, v. 6, no. 3, Mar. 1959, p. 3-8.

7993 A 20,000-Kilowatt Nuclear Turboelectric Power Supply for Manned Space Vehicles. A conceptual design of a nuclear turboelectric powerplant suitable for manned space vehicles. ***Robert E. English.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 2-20-59E, Mar. 1959, 65 pp. (TL782 Un3rm Vis.)

See also: 7880 (ramjet engine fuels).

INFORMATION—PREPARATION AND DISSEMINATION

7994 Soviet Documentation. A Trip Report. A summary of four weeks spent in the U.S.S.R. studying documentation activities. ***Allen Kent and A. S. Iberall.*** *American Documentation*, v. 10, no. 1, Jan. 1959, p. 1-19.

7995 A First Approach to Patent Searching Procedures on Standard's Electronic Automatic Computer (SEAC). The procedures include four routines: (1) disclosure data preparation, (2) question data preparation, (3) search, and (4) check-out. This article is substantially limited to describing the search routine. ***Harold Pfeffer, Herbert R. Koller, and Ethel C. Marden.*** *American Documentation*, v. 10, no. 1, Jan. 1959, p. 20-26.

7996 Display of Chemical Structural Formulas as Digital Computer Output. Equipment and techniques are described. ***Ascher Opler and Norma Baird.*** *American Documentation*, v. 10, no. 1, Jan. 1959, p. 59-63.

7997 Some Comments on the IRIA Retrieval System. IRIA was established by an Office of Naval Research contract for the, ". . . . collection, evaluation, and dissemination of all information concerning research and development in the fields of infrared physics and technology . . .". ***William Wolfe.*** *American Documentation*, v. 10, no. 1, Jan. 1959, p. 74-77.

7998* Blueprint for a Library. Suggests and explains two-level system of coding for computer to be used by university research workers and also by students and faculty. ***Beatrice H. Worsley.*** *Computers and Automation*, v. 8, Apr. 1959, p. 17-20.

7999 Engineering Information. All Is Not Lost. A review of the activities and services of the Engineering Societies Library. Its unique documentation center and unrivalled search facilities have earned it world-wide reputation and use. ***R. H. Phelps.*** *Electrical Engineering*, v. 78, Apr. 1959, p. 332-334.

8000* Writing Papers for Readability. Readability must arise from intelligent planning and organization of the material and from an understanding of the psychological process of reading. ***John S. Fielden.*** *Mechanical Engineering*, v. 81, Mar. 1959, p. 46-47.

8001 Iron and Steel Translation Service. A translation of any foreign article on iron and steel manufacture can now be provided at a fraction of the translating cost, provided that three requests for it are received by the British Iron and Steel Industry Translation Service. This service is run by The Iron and Steel Institute with the collaboration of several large companies and of the British Iron and Steel Research Association. Some 530 translations are already available—a large proportion of them from German or Russian. *Metallurgia*, v. 59, Mar. 1959, p. 156.

8002* The Importance of Keeping Records of Inventions. The time factor is patent grants: records testify to inventor's claim to invention. ***Alfred E. Wilson.*** *Tooling & Production*, v. 25, no. 1, Apr. 1959, p. 51-52.

See also: **7409** (refractories bibliography).

INSTRUMENTATION

8003 Electronic Controlled-Potential Coulometric Titrator. Simple electronic instrument for coulometric redox titrations at controlled potential is described. ***M. T. Kelley, H. C. Jones, and D. J. Fisher.*** *Analytical Chemistry*, v. 31, Apr. 1959, p. 488-491.

8004 Apparatus and Technique. An alarm for the detection of toxic industrial gases. *Chemistry & Industry*, 1959, no. 11, Mar. 14, p. 361-363.

8005 The Recording and Collocation of Waveforms. Describes the design and performance of the first commercially available Ekco Strobograph designed for the most general application in oscillography. ***R. J. D. Reeves.*** *Electronic Engineering*, v. 31, Apr. 1959, p. 204-212.

8006 Designing a Spectrum Analyzer. Complete design criteria on a spectrum analyzer is presented for the guidance of both the instrument manufacturer and the user. ***Robert Saul and Elaine Luloff.*** *Electronic Industries*, v. 18, Apr. 1959, p. 66-71.

8007 Digital Tachometer Aids in Turbine Design. Describes a tachometer which counts up to 400,000 rpm on two scales at an accuracy of 0.005%. By generating 30 pulses for each revolution and holding gate open for two minutes, direct indication in rpm is provided on counting tubes. Timing unit that controls gate can also be used as frequency standard. ***John K. Goodwin.*** *Electronics*, v. 32, no. 15, Apr. 10, 1959, p. 58-61.

8008 Ultra-Precise Quartz Crystal Frequency Standards. The use of temperatures near absolute zero to increase Q and frequency stability in ultra-precise quartz crystal oscillators is described. A brief general description is also given of the design and performance of some such oscillators developed at Bell Telephone Labs. ***A. W. Warner.*** *IRE Transactions on Instrumentation*, v. I-7, nos. 3-4, Dec. 1958, p. 185-188. (TK1 In6.6i Vis.)

8009 Principles and Application of Radio Interference Measurements. A review of the present status of radio interference instrumentation, the problems associated with its use and standardization, and probable areas of future development. ***W. E. Pakala and R. M. Showers.*** *IRE Transactions on In-*

strumentation, v. I-7, nos. 3-4, Dec. 1958, p. 297-303. (TK1 In6.6i Vis.)

8010 The Theory of Low-Temperature Bolometer Detectors Applied to the Measurement of Low-Level RF Power. The authors derive expressions for the minimum detectable signal as a function of the numerous parameters concerned. ***D. L. Birx and N. Fuschillo.*** *IRE Transactions on Instrumentation*, v. I-7, nos. 3-4, Dec. 1958, p. 310-315. (TK1 In6.6i Vis.)

8011 Theory and Design of Getter-Ion Pumps. ***L. Holland.*** *Journal of Scientific Instruments*, v. 36, Mar. 1959, p. 105-116.

8012 Electrolytic Hygrometers for Measurements in Gases Down to a Few Parts per Million. Another method for making electrolytic hydrometers is described, together with detailed measurements of their characteristics. An instrument is described for making rapid specification tests on cylinders of the refrigerant dichlorodifluoromethane. ***J. K. Crawshaw and F. G. Davidson.*** *Journal of Scientific Instruments*, v. 36, Mar. 1959, p. 121-125.

8013 Cryostat for Measuring the Electrical Properties of High Resistance Semiconductors at Low Temperatures. This apparatus enables measurements to be made on semiconductors of resistance up to $10^{11}\Omega$ at temperatures down to 2 K. A vibrating reed electrometer is used for the measurements. The characteristics of suitable instruments are described and the performance of the apparatus is illustrated by showing some results obtained for a specimen of gold doped silicon. The maximum specimen resistance which can be used is determined by the self-capacity of the apparatus. The noise level in the electrometers sets a lower limit for the measurement of Hall mobility at about 10 $cm^2\ V^{-1}s^{-1}$. ***W. H. Mitchell and E. H. Putley.*** *Journal of Scientific Instruments*, v. 36, Mar. 1959, p. 134-136.

8014 New Radiation Pyrometer. Temperature Measurement in Induction Hardening. The instrument consists of a thermopile specially constructed so as to give an electrical output substantially independent of ambient temperature over a wide range of source temperature. It may be used with a radiation collecting probe or with an aperture stop—or system of collimating stops—in the path of the incident radiation. Successful use has been made of a fused silica probe in an induction hardening and tempering process when the source area was small and was normally obscured by quench oil, spray, and smoke. *Metallurgia*, v. 59, Feb. 1959, p. 86-87.

8015 Exhibits of Metallurgical Interest at the Physical Society's Exhibition. The exhibits at the Physical Society's annual exhibition of scientific instruments usually include a number of interest to workers in the metallurgical field. This year was no exception, and in this issue we continue a short series of reviews in which such items will be described. X-ray fluorescence spectrometer, vacuum fusion gas analysis, gas chromatography recorder, and automatic chart analysis. *Metallurgia*, v. 59, Mar. 1959, p. 157-158.

8016* Indirect Measurement of Rolling Loads. The method is based on the measurement of the elongation of the rolling mill stand column under the rolling load. The design of the apparatus, its mounting on the roll-stand, and electrical circuit were described. The elongation is measured by an induction method. In order to obtain maximum sensitivity, the electrical circuit was analyzed. The calibration was made both by computation and by empirical method. The errors of calibration by computation and the differences between both methods were emphasized. Errors due to temperature effects and lack of mechanical precision were also mentioned. The tests have shown that the apparatus is satisfactory for the rolling-load control when the accuracy of about ± 10% is sufficient. In this method, the measurement is possible even when lack of space or other reasons render impossible the installation of other load-meters. (*In Polish.*) Pośrednie pomiary nacisków podczas walcowania. ***R. Hagel, J. Jońca, and Z. Kazior.*** *Prace Instytutów Hutniczych*, 1959, no. 1, p. 25-31.

8017* Load-Cells for Measurement of Large Rolling Loads. The purpose of load-cells is to control loads during actual rolling. After critical review of various methods, the strain gage method was chosen with gages cemented on a cylindrical block alternately circumferentially and lengthwise and connected in a bridge circuit. The permissible supply current of the circuit and signal strength obtained were especially emphasized. The electrical circuit permits both A.C. and D.C. measurement. In the case of D.C., the measurement without amplification is possible. The mechanical design of a prototype load-cell for pressures up to 500 tons was described. After trials under actual rolling conditions, this design was modified and a series of cells for loads from 10 to 1300 tons was constructed. Properties of these cells were found to be satisfactory; the accuracy for A.C. and D.C. measurement was respectively ± 2% and ± 1.5% of upper limit of load range. (*In Polish.*) Czujniki do pomiarów dużych nacisków walcowniczych. ***J. Jońca and J. Rabalski.*** *Prace Instytutów Hutniczych*, 1959, no. 1, p. 33-40.

8018* A Precision Gas Chromatograph for Use in Works Laboratories. Novel, particularly serviceable method for analyzing gases and evaporable liquids. Device operating on this method lends itself to both qualitative and quantitative analyses. Under normal working conditions, a sensitivity (limit of response) of 10 ppm is attained. (*In German.*) Ein Präzisions-Gas-Chromatograph für das Betriebslaboratorium. ***Helmut Oster.*** *Siemens Zeitschrift*, v. 33, no. 3, Mar. 1959, p. 137-144.

8019* The Describing Function Technique. Explains the use of the describing function technique which is most useful in assessing quite simply the possibility of self-maintained oscillations due to the nonlinear characteristic which would not be present in the linear system. Shows graphically how the necessary modifications to eliminate this oscillation can be determined. **John C. West.** *Society of Instrument Technology, Transactions*, v. 2, no. 1, Mar. 1959, p. 1-9.

8020* Practical Aspects of Radiation Pyrometry. This paper is written for the practical instrument engineer who may be thinking of using radiation pyrometers in industry. Typical applications in a wide variety of industries are used to illustrate the principles. ***T. Land.*** *Society of Instrument Technology, Transactions*, v. 2, no. 1, Mar. 1959, p. 10-18.

8021* Predicting the Reliability of Complex Electronic Equipment. The reliability of complex electronic equipment is calculated on the basis of a constant component failure rate. The effects of ambient conditions on failure rate are discussed. ***A. G. Field.*** *Society of Instrument Technology, Transactions*, v. 2, no. 1, Mar. 1959, p. 18-23.

8022* Some Applications of Control Technique in Astronomy. The present trend in the construction of large telescopes demands the increasingly close tolerances in the adjustment of the major optical parts of telescopes. The need is emphasized for the development work on tolerance control systems using servo techniques. ***P. B. Fellgett.*** *Society of Instrument Technology, Transactions*, v. 2, no. 1, Mar. 1959, p. 24-38.

8023* A Simple Data Read-Out System. The equipment described was built for the Bristol No. 4 (low-speed) wind tunnel, but is of general application. It is of medium speed only, and is fed by binary-coded-decimal digital transducers. A single decorder operating upon each decimal digit serially, a scanner, and a pulse generator form the essentials of the system. ***G. P. Tonkin and J. B. Bownas.*** *Society of Instrument Technology, Transactions*, v. 2, no. 1, Mar. 1959, p. 39-49.

8024* Digital Data-Recording for Nuclear Experiments. Describes nuclear instruments equipped with devices for recording digital data in a form suitable for automatic processing. ***R. C. M. Barnes.*** *Society of Instrument Technology, Transactions*, v. 2, no. 1, Mar. 1959, p. 49-58.

See also: **7366** (integrating accelerometer); **7347** (control valves).

LUBRICATION AND FRICTION

8025* Radioactive Determination of Bearing Wear in a Refrigeration Compressor. Theoretical load-carrying capacity at different operating conditions is compared to actual bearing

wear determined by radioactive methods. This technique allows a continuous and rapid evaluation of a complete fluid film bearing system. ***G. R. Fox and R. C. Elwell.*** *Lubrication Engineering*, v. 15, Apr. 1959, p. 144-151.

8026* Effect of Solid Additives on Fluid Lubricants. The effect of solid additives in fluid lubricants on the coefficient of friction is attributed to the ability of additives to smooth the surface of a bearing during operation and to the shear strength of the additives. By proposed empirical formulation, the effects of particle dimension and concentration of the additive, and the effect of error in geometry of the bearing are quantitatively described. Data from a foil-bearing experiment supports the formulation and confirms the potential of molybdenum disulfide as an additive to fluid lubricants. ***Harold L. Herzig.*** *Lubrication Engineering*, v. 15, Apr. 1959, p. 152-158.

8027* Comparison of Temperature Effects on the Flow Properties of Greases in Capillary and in Cone and Plate Viscometers. Flow properties of greases obtained with a capillary viscometer were compared with those measured by means of a cone and plane viscometer. Energies of activation for viscous flow calculated from the apparent viscosities obtained from capillary flow data differ from those calculated from the apparent viscosities given by the cone and plate viscometer. Results indicate that various structural elements in the grease have different temperature coefficients of resistance to flow, and that the extent of destruction of such elements is markedly different in the two types of viscometers. ***W. H. Bauer, A. P. Finkelstein, D. O. Shuster, and S. E. Wiberly.*** *NLGI Spokesman*, v. 23, no. 1, Apr. 1959, p. 15-24.

8028* Recent Developments and Trends in Industrial Gear Lubricants. ***E. S. Reynolds.*** *NLGI Spokesman*, v. 23, no. 1, Apr. 1959, p. 25-26.

8029 Extreme Pressure Lubricants. Reviews the properties of some of the materials which have been added to lubricating oils and the methods used to evaluate their effectiveness. ***N. Pilpel.*** *Research*, v. 12, Apr. 1959, p. 141-147.

8030* Radioactive Methods for Determining the Influence of Viscosity Upon the Lubricant Film Thickness. ***D. Pavelescu and I. Iliuc.*** *Revue de Mécanique Appliquée*, v. 3, no. 3, 1958, p. 299-312.

See also: **7587** (preparation of lubricants).

MECHANICAL ENGINEERING

8031* Theoretical Stresses Near a Circular Opening in a Flat Plate, Reinforced With a Cylindrical Outlet. The plate is loaded in tension, either uniformly in all directions, or with transverse and longitudinal tensions in the ratio of 2:1 as is the case in cylindrical pressure vessels. Consideration is given to the possibility of "balanced reinforcement" by adding material on both sides of the plate. Tables and graphs are included for the use of designers who wish to find the stress-concentration factors for different combinations of plate thickness, outlet-wall thickness, and outlet diameter. ***Everett O. Waters.*** *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 81, no. 2, Apr. 1959, p. 189-200.

8032 Thermal Stresses and Deflections in Rectangular Sandwich Plates. Equations are developed for bending and torsional moments and transverse shear forces. Special attention is paid to the required edge reactions. Except for cases where all edges are clamped or all edges are simply supported, transverse shear forces occur, so that the shear deformation of the core has to be considered. Plates with two opposite edges simply supported and the other two free or clamped are dealt with. ***P. P. Bijlaard.*** *Journal of the Aero/Space Sciences*, v. 26, Apr. 1959, p. 210-218.

8033* The Stability of a Circular Cylinder Under Finite Extension and Torsion. For large torsions equilibrium is unstable; determines the relations that exist between the extension, torsion, and dimensions of the cylinder when instability first occurs. The theory is developed for a general elastic material as far as the formulation of the neutral equilibrium equations. A condition for the existence of an adjacent equilibrium position is found in the form of a relation between the roots of a transcendental determinental equation and the dimensions of the cylinder. This equation is solved numerically for a particular value of the extension ratio, and also for the case in which there is torsion but no extension. Criteria for instability in these cases are presented. ***A. E. Green and A. J. M. Spencer.*** *Journal of Mathematics and Physics*, v. 37, no. 4, Jan. 1959, p. 316-338.

8034* On the Foundations of the Theory of Thin Elastic Shells. Deals with the fundamental problem of establishing two dimensional systems of differential equations for stresses and displacements of thin elastic shells. Derives a system of equations as a logical consequence of the known system of differential equations of three-dimensional elasticity, with the possibility of establishing shell theories of varying degrees of accuracy. The work is limited to a consideration of the problem for the circular cylindrical shell of constant thickness, under the assumption of small rotationally symmetrical deformations. ***M. W. Johnson and E. Reissner.*** *Journal of Mathematics and Physics*, v. 37, no. 4, Jan. 1959, p. 371-392.

8035 Thermal Stresses in Design. X. Elastic Stresses by Minimizing Residuals. A general method for solution of two-dimensional thermal-stress problems. ***S. S. Manson.*** *Machine Design*, v. 31, Mar. 19, 1959, p. 191-197.

8036 Cognate Linkages. How to find linkages of different proportions and operating characteristics that produce the same coupler-point curve. ***R. S. Hartenberg and J. Denavit.*** *Machine Design*, v. 31, Apr. 16, 1959, p. 149-152.

8037 Proceedings of the Third U.S. National Congress of Applied Mechanics. Brown University, June 11-14, 1958. ***R. M. Haythornthwaite, editor.*** The American Society of Mechanical Engineers, New York. 1958, 864 pp. (TA350 Un4p Over.)

8038 A Survey of the Theories of Creep Buckling. Two fundamentally different approaches to the solution of the buckling problem are discussed. In one, the structural element is assumed to be perfect and perfectly centered under the loads and buckling is initiated by a disturbance in the equilibrium configuration. In the second, the creep deformations begin in consequence of the deviation of the unloaded centerline or median plane of the structural element from the line of load application. ***N. J. Hoff.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 29-49. (TA350 Un4p Over.)

8039 Rotationally Symmetric Problems in the Theory of Thin Elastic Shells. Reviews a number of problems and solutions in the field of rotationally symmetric deformations of thin shells, all of them dealing with shells of revolution which are the most natural source of such problems. Consideration is given to linear and nonlinear problems of the statics of shells of revolution, with particular emphasis on asymptotic solutions and edge effects. In addition, the problem of bending of pressurized curved tubes is formulated in considerable generality. ***Eric Reissner.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 51-69. (TA350 Un4p Over.)

8040 The Solution of Duffing's Equation for the Softening Spring System Using the Ritz-Galerkin Method With a Three Term Approximation. The differential equation was solved for both free and forced oscillations. Solutions are presented in the form of amplitude vs frequency plots for the three components of the assumed solution. Resonance of the harmonics is indicated in certain regions of the amplitude vs frequency plane. In these regions, the fundamental component alone is not adequate in describing the response of the system. ***Cyril P. Atkinson and Charles P. Bourne.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 71-77. (TA350 Un4p Over.)

8041 The Response of Elastic Spherical Shells to Spherically Symmetric Internal Blast Loading. A general theory of the small-deformation elastic response of spherical shells of any thickness to spherically symmetric internal blast waves is developed. The theory is approximated for thin shells, and compared with experiment. ***Wilfred E. Baker and Frank J. Allen.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 79-87. (TA350 Un4p Over.)

8042 On Elastic Impacts of Spheres on Long Rods. Presents an experimental verification and a theoretical analysis for the longitudinal elastic impact of steel balls on an infinitely long cylindrical steel bar. Five balls of diameter ranging from 1 to 2 inches were dropped from heights ranging from 7.5 to 30 centimeters to impact longitudinally a 1-inch diameter bar. Experimental results compare in table and graph form the pulse length, pulse amplitude, pulse shape, and time of peak amplitude as computed from the theoretical analysis. The electronic circuitry and equipment developed are described. The theoretical analysis indicates the validity of the Hertzian impact assumptions. ***Cliff S. Barton, Enrico G. Volterra, and S. J. Citron.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 89-94. (TA350 Un4p Over.)

8043 Vibration Analysis by the Root Locus Method. The method is explained using, as a model, a two-stage "shock mount" with heavy damping. The ready physical interpretation of root locus plots is demonstrated. Quick graphical conversion to system frequency response is also shown. Treatment of additional degrees of freedom is indicated. ***Robert H. Cannon, Jr.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 95-100. (TA350 Un4p Over.)

8044 Vibration of Rectangular Plates and Plate Systems. A procedure for analyzing the steady-state free or forced vibration of single-span plates and continuous plates on nondeflecting supports is presented. The method is analogous to the slope-deflection method used in structural dynamics to analyze the vibration of continuous beams and frames. Natural frequencies of single-span plates for various boundary conditions are obtained as examples of the procedure. ***E. H. Dill and K. S. Pister.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 123-132. (TA350 Un4p Over.)

8045 Stresses in Curved Beams Due to Transverse Impact. A sequence of photoelastic fringe patterns in curved and cantilever beams have been obtained by repeating the impact of a sphere on the free end of these bars and photographing the event at known time intervals. Static and dynamic values of the stress-optic coefficient and the modulus of elasticity are determined for CR-39, and the maximum values of the experimentally determined stresses for both static and dynamic loading conditions on a bent, a quarter circle, and a cantilever beam consisting of this material are compared. ***Werner Goldsmith and G. W. Norris, Jr.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 153-162. (TA350 Un4p Over.)

8046 Flexural Vibrations of a Thick Walled Circular Cylinder. Treats the flexural vibrations of a hollow circular cylinder of finite length, which is kept circular at its ends. The three-dimensional theory of elasticity is used and solutions to the equations of motion satisfying given boundary conditions are obtained. Curves of frequency parameter as a function of length ratio and thickness ratio are given. ***Joshua E. Greenspon.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 163-173. (TA350 Un4p Over.)

8047 Vibrations of a Uniform, Rotating Beam With Tip Mass. The effect of an added tip mass on the transverse vibrations of a uniform, cantilevered beam rotating with constant velocity about an axis through the clamped end is considered. Upper and lower bounds are established for the lowest frequency as a consequence of the minimum principle. It is shown that the tip mass tends to decrease the frequency as compared with the beam with free end. The first term in the asymptotic development for high modes is obtained. ***George Handelman, William Boyce, and Hirsh Cohen.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 175-180. (TA350 Un4p Over.)

8048 Propagation of Abrupt Circular Wave Fronts in Elastic Sheets and Plates. An in-plane or transverse ring load is suddenly applied to an elastic, homogeneous, isotropic sheet (plane stress) or plate (flexure). Abrupt wave fronts of stress and velocity or moment and velocity are produced, spreading outward and inward in concentric circles. The method of characteristics is used to determine the velocity of propagation and amplitude variation of these circular wave fronts before reflection. The amplitudes of all circular fronts vary inversely as the square root of the radius. ***W. E. Jahsman.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 195-202. (TA350 Un4p Over.)

8049 Thermally Induced Elastic Wave Propagation in Slender Bars. Both semi-infinite and finite bars are treated. In each, the bar is considered to be disturbed from rest in its equilibrium position with ends stress-free. The temperature distribution is an arbitrary function of time and one-dimensional space. Solutions are obtained by the method of integral transforms. As an example, a simple temperature distribution function is applied to the solution for the semi-infinite bar to illustrate the phenomenon. Results indicate that the phenomenon should be considered in investigations of the mechanism of structural failure due to thermal impact (extreme thermal shock). ***J. E. Michaels.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 209-213. (TA350 Un4p Over.)

8050 Ellipsoidal Shells Subjected to Lateral Hydrostatic Loading. The solution is obtained for the membrane stresses in a semi-ellipsoidal shell of revolution subjected to internal pressure varying linearly in a direction normal to the axis of revolution. This solution is applied to the calculation of the membrane stresses in the ellipsoidal head of a fluid-filled, horizontal, cylindrical tank. It is pointed out that circumferential compressive stresses exist over substantial portions of the head thereby giving rise to the possibility of buckling in this region. ***J. H. Baltrukonis.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 247-252. (TA350 Un4p Over.)

8051 Elastic Theory of a Weak-Core Sandwich Panel, Initially Warped, Simply Supported, and Subjected to Combined Loadings. The loads applied consist of arbitrarily distributed transverse loads and eccentrically applied edge loads and/or edge moments. Solutions of the differential equations for a simply supported rectangular panel with arbitrary initial warping and subjected to combined transverse loading and edge compression are obtained in the form of double Fourier series. ***Chieh-Chien Chang, Bertrand T. Fang, and Ibrahim K. Ebcioglu.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 273-286. (TA350 Un4p Over.)

8052 Solution of the Equations of Thermoelasticity. Helmholtz's theorem on the resolution of a vector is applied to the displacement in the thermoelastic field equations. The result is employed to study dilational motion in an unbounded solid, longitudinal motion of an infinite circular cylinder, and thickness-stretch motion in an infinite slab. ***H. Deresiewicz.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958. p. 287-291. (TA350 Un4p Over.)

8053 Effect of Imperfections on Buckling of Thin Cylinders With Fixed Edges Under External Pressure. Buckling of thin fixed edge cylinders under all-around pressure is studied, using finite deflection theory and assuming imperfec-

tions of the type assumed in prior studies of other cases. No drop-off in resistance after buckling is found in this case, so that peak resistance is determined by the onset of yielding at highly stressed points. Results found are consistent with tests and the range of imperfections found necessary to explain test results in other cases. ***L. H. Donnell.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 305-311. (TA350 Un4p Over.)

8054 Thermal Singularities for Cylindrical Shells. Singular solutions of the equations of the shallow cylindrical shell, or alternatively of the Donnel equations of the complete cylinder, are presented. It is shown that two of these solutions may be physically interpreted as thermal singularities, i.e., plane and bending hot spots. It is further shown that the concentrated force is not included among the solutions presented. Suggestions are made for applying the singularities to the solution of cylindrical shells with arbitrary temperature distribution. ***W. Flügge and D. A. Conrad.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 321-328. (TA350 Un4p Over.)

8055 A Non-Destructive Method for Three-Dimensional Photoelasticity. It is shown that the data required for the three-dimensional shear-difference method can be obtained by means of scattered light without slicing the model, (and perhaps even without freezing), thereby providing a non-destructive method for three-dimensional photoelasticity. The necessary theory of scattered light is developed and experimental evidence provided showing the possible accuracy in the determination of the isoclinic parameters and birefringence. The possibilities of the method are further demonstrated by determining the stress distribution along critical lines in a diametrically compressed sphere and comparing the results with theory and previous experiments. ***M. M. Frocht and L. S. Srinath.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 329-337. (TA350 Un4p Over.)

8056 Formulas for Overall Thermoelastic Deformation. The temperature distribution being arbitrary, it is shown that thermal stress gives zero total change of volume (above that of free thermal expansion). Formulas are found for the change of contained volume of thick-walled closed vessels, and for over-all extensions, deflections, and rotations of flexural and torsional types, in bars of arbitrary section. ***J. N. Goodier.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 343-345. (TA350 Un4p Over.)

8057 Thermal Stresses in a Sector Prism. It is shown in this paper that sectioning the cylinder into six pie-shaped sectors, so as to provide more freedom for deformation but retaining the temperature distribution, reduces the maximum stress by about 30%. ***K. L. Hanson and G. Horvay.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 347-356. (TA350 Un4p Over.)

8058 Strain Energy and Equilibrium of a Shell Subjected to Arbitrary Temperature Distribution. The equations for small deflections of any shell are generalized to include the effects of a temperature distribution that is an arbitrary function of the curvilinear coordinates (x, y, z) of the shell. Additionally, the strain energy expression for any elastic isotropic shell is developed for an arbitrary temperature distribution. The analysis is based on the Kirchhoff assumption that normals to the middle surface remain straight and normal. Also, small-deflection approximations are used. Only elastic isotropic shells are considered, although a part of the theory is independent of the stress-strain relations. ***H. L. Langhaar and A. P. Boresi.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 393-399. (TA350 Un4p Over.)

8059 Pressure and Thermal Stress Analysis of Plate-Type Fuel Subassemblies. Finite difference equations are employed to determine a closed form solution for the redundant reactions in a plate-type fuel subassembly for a nuclear reactor. Both pressure and thermal loading are considered. The results are compared with a photoelastic analysis and with the values predicted by a simplified continuous elastic foundation theory. ***N. C. Small.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 451-459. (TA350 Un4p Over.)

8060 Thermal Stresses in Laminated Circular Plates. The governing general plate equations are derived for an isotropic thermoelastic plate composed of two laminae, subjected to an arbitrary axi-symmetric temperature distribution, varying along the radius and through the thickness. ***Jack R. Vinson.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 467-471. (TA350 Un4p Over.)

8061 Normal Incidence in the Determination of Large Strain Through the Use of Diffraction Gratings. The advantage of using normal incident light is discussed for the measurement of large strain by means of diffraction gratings. Exact expressions for both strain and surface angle are obtained and a direct method of over-all calibration is discussed. Results are given for a 30,700 lines per inch, 0.010-inch long diffraction grating gage on a specimen undergoing dynamic plastic strain from a constant velocity impact. ***James F. Bell.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 489-493. (TA350 Un4p Over.)

8062 Studies in Photoplasticity. Using thin models of cellulose nitrate, factors of stress concentration and stress distributions were determined for several basic cases. The extension is made possible by the establishment of a suitable stress-optic law, and the employment of the shear-difference method. The results obtained are in substantial agreement with theory and experiment. The method is at present limited to plane stress problems in the elasto-plastic state without unloading. ***M. M. Frocht and R. A. Thomson.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 533-540. (TA350 Un4p Over.)

8063 The Load-Carrying Capacity of Wide Beams at Finite Deflection. Estimates of the post-yield carrying capacity of laterally loaded plates may be obtained conveniently from the velocity fields associated with either the limit load or the membrane solution. The latter can be used even when the limit load is not known. The velocity field includes both a local circular symmetric deformation near the load and also a general beam bending mechanism. The rate of deflection is computed and the field is also used to obtain an upper bound to the limit load. Comparison is made with the results of tests of six steel beams of various widths. ***R. M. Haythornthwaite and W. E. Boyce.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 541-550. (TA350 Un4p Over.)

8064 Yield Failure of Stiffened Cylinders Under Hydrostatic Pressure. Experimental results are presented of hydrostatic tests of stiffened cylinders failing by axisymmetric yielding. These results are compared with existing theories predicting the collapse pressure as well as a new method presented in this paper. This method is based on an elastic-plastic analysis of a stiffened cylinder comprised of an ideally plastic material. The experimental collapse pressures agree best with theories using a Hencky-von Mises criterion of yielding and allowing for plastic reserve strength after the initiation of yielding. ***M. E. Lunchick.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 589-594. (TA350 Un4p Over.)

8065 Limit Strength of Thin Walled Pressure Vessels With an ASME Standard Torispherical Head. Results are presented for the maximum pressure which an unfired vessel with an ASME standard torispherical head can withstand before appreciable plastic deformation will occur. The effect of flanges on strength is considered. A comparison is made with the ASME Code for unfired pressure vessels. A real danger is pointed out which is especially important in connection with brittle fracture at low temperature. ***R. T. Shield and D. C. Drucker.*** Paper

from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 665-672. (TA350 Un4p Over.)

8066 On Transient Thermal Stresses in Linear Viscoelasticity. The principle of correspondence appropriate to the linear theories of elasticity and viscoelasticity is extended to account for the presence of a time-dependent temperature field, and is applied to the quasi-static determination of transient thermal stresses in a general, linear, homogeneous and isotropic, infinite viscoelastic medium with a spherical cavity. It is assumed that the body is free from loading and that the stress-inducing temperature distribution has polar symmetry about the center of the cavity. ***Eli Sternberg.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 673-683. (TA350 Un4p Over.)

8067* Contributions to the Problem of Building Vibrations During Earthquakes. On the Adaptation of Geiger's Formula. Expressions of the frequency of vibration obtained under two hypotheses, as well as Geiger's formula adapted to the present problem, give satisfactory results. Their application is simple and avoids laborious analytical operations such as those needed for obtaining the frequency by classical methods or other procedures. The mistakes which would possibly occur during the calculation when using more complicated methods are also shown. ***Mihail Ifrim.*** *Revue de Mécanique Appliquée,* v. 3, no. 2, 1958, p. 151-168.

8068 Theoretical Determination of Lifetime of Compressed Plates at Elevated Temperatures. Linearized equations are used with the assumption that the plate material is a standard linear solid. The critical time (lifetime) is determined by reducing the time-dependent behavior to the time-independent response of purely elastic buckling. ***George Herrmann and Hu-Nan Chu.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 2-24-59W, Mar. 1959, 21 pp. (TL782 Un3rm Vis.)

8069* Vulkollan as Construction Material for Engineering Applications. Vulkollan is a flexible plastics material, which can be produced to range in character from soft rubber to vulcanite, depending on the quantivalent ratio of the starting components. Physical properties of this material enable it to fill the gap between flexible rubber and hard thermoplastics. (*In German.*) Vulkollan als Konstruktionswerkstoff für den Maschinenbau. ***Ulrich Knipp.*** *VDI Zeitschrift,* v. 101, no. 9, Mar. 21, 1959, p. 350-356.

See also: **7956** (vibration tests for jet engines); **7976** (air engines); **8222** (designing with powder-metal parts); **8435** (automatic film feeding).

METALLURGY

8070* Applications of Ductile Cast Iron in the Field of Pipelines. Ductile or spheroidal-graphite cast iron is a new material particularly suitable for pipelines. The good mechanical properties and the corrosion resistance of this material, linked with its capability of production by centrifugal casting, give to ductile cast-iron pipes over-all properties hitherto unknown. These pipes, assembled either with flexible rubber joints or by means of high-precision screwed joints, have made possible extremely interesting applications. Several important pipelines have been in use for many years all over the world, for water and gas at high pressures, as well as for heating, loading, and unloading tankers. ***Maurice C. M. Grandpierre.*** *British Foundryman,* v. 52, Feb. 1959, p. 61-65.

8071 Alloys for the Aircraft Industry. The Role of Cobalt. Generally, the cobalt-base alloys find use above 1600 F and at low stress for short periods of time up to 2200 F. ***F. R. Morral.*** *Cobalt,* no. 2, Mar. 1959, p. 23-36.

8072* Using Infrared Rays for Drying Purposes and Applications of This Method in the Foundry. Part of the IR radiation hitting a substance is reflected according to the color, nature and humidity of the substance; the other part penetrates into the substance and generates heat. The drying process is more rapid, the furnace and the upkeep are less expensive than by the hot-air method. (*In Italian.*) L'essiccamento con raggi Infrarossi e le sue applicazioni in fonderia. ***Pier Giacomo Lanino.*** *Fonderia,* v. 8, Feb. 1959, p. 41-46.

8073 A Redetermination of the Volume Changes on Solidification and Fusion of Lead-Bismuth Alloys Near to the Eutectic Composition. *C. T. Preston and G. H. Broomfield.* *Institute of Metals, Journal,* v. 87, pt. 7, Mar. 1959, p. 240.

8074 Metallurgical Research in Japan. Nearly ten million dollars was expended by the 46 leading research organizations during 1958, corresponding to 0.5% of the gross sales of iron and steel. This article describes current fields of interest. ***Tokushichi Mishima.*** *Journal of Metals,* v. 11, Mar. 1959, p. 168-169.

8075 Binary and Ternary Alloys of Tin With the Elements of Groups IIB, IIIB and VB of the Periodic Table. The effect of third metals on the simple hexagonal Sn-rich intermediate phases of the β Sn-Cd type, Sn-rich alloys of the systems Sn-Cd-Tl, Sn-Cd-Bi, and Sn-In-Sb have been examined by metallographic, X-ray, and electrical resistance methods. Experiments on the binary systems Sn-Cd, Sn-Zn, Sn-Tl, and Sn-In were also carried out to clarify discrepancies in the literature. ***H. W. Rayson, C. W. Goulding, and G. V. Raynor.*** *Metallurgia,* v. 59, Feb. 1959, p. 57-62.

8076 Clad Aluminium Alloys. While the aircraft industry remains the leading user of clad aluminum alloys, chemical engineering uses are increasing in importance, particularly as long and satisfactory experience is being gained in existing applications. The manufacture, properties, and applications of these materials are discussed here and reference made to the use of cladding techniques for special products such as sheet for anodizing or brazing purposes. ***F. C. Porter.*** *Metallurgia,* v. 59, Feb. 1959, p. 67-73.

8077 The Progress of Aluminium as a Building Material. *E. H. Laithwaite.* *Metallurgia,* v. 59, Feb. 1959, p. 74-78.

8078 Aluminium and Its Alloys in 1958. Some Aspects of Research and Technical Progress Reported. Attention is drawn to work published in Great Britain and the U. S. A., reporting research and technical progress in the various aspects of the metallurgy of aluminum and its alloys, including extraction, founding, fabrication, constitution, properties, and standardization. Reference is also made to interesting applications of these materials. ***E. Elliott.*** *Metallurgia,* v. 59, Feb. 1959, p. 79-85.

8079 Copper and Copper Alloys. A Survey of Technical Progress During 1958. Continued progress has been made in the past year in the metallurgy of copper and its alloys, and in the various sections of this review the author discusses the principal items of interest concerning such aspects as raw material resources, extraction, fabrication, finishing, and properties. ***E. Voce.*** *Metallurgia,* v. 59, Feb. 1959, p. 88-92.

8080 Copper and Copper Alloys. A Survey of Technical Progress During 1958. *E. Voce.* *Metallurgia,* v. 59, Mar. 1959, p. 131-138.

8081 Fuel Containers for Rockets. Weight restrictions, high pressures, and wide operating temperture ranges—all must be considered in producing missile fuel vessels. Material choice is limited, and optimum joining methods are still to be developed. Careful testing is needed to determine the quality of both factors. ***Donald E. Nuk.*** *Metal Progress,* v. 75, no. 3, Mar. 1959, p. 66-72.

8082 New Look Comes to Steel. A new vinyl-coated steel just announced by U. S. Steel Corp. Supplied as sheets and coils in many surface textures, the precoated steel is made by a method developed by the company's researchers to cure and bond liquid vinyl plastisols to the metal. A key problem was to perfect a way to retain sharp definition of embossed patterns in the vinyl coatings during fabrication by deep drawing and

bending. Vinyl-coated steel is supplied up to 52 in. wide, in coils or cut lengths, on either cold rolled, galvanized, or galvanized Paintbond steel. Both commercial quality for flat work and special killed steel for deep drawing are offered. Conventional shearing offers no problems. Sheets have been run through high-speed blanking operations without difficulty. With clean tools and adequate clearance, press brake forming is satisfactory. Extremely sharp corners may be produced if needed. *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 126-127.

8083* Fabrication and Uses of the New Metals. In the 1958 Viscount Nuffield Paper, delivered before the Institution of Production Engineers at the University of Birmingham, March 11, Dr. N. P. Inglis, Research Director, Metals Division, ICI, Ltd., outlined production and fabrication problems associated with some of the newer models, notably titanium, zirconium, beryllium, and niobium, and emphasized the growing importance of these materials to modern industrial developments. *Metalworking Production*, v. 103, no. 12, Mar. 20, 1959, p. 511-512.

8084 What's Coming in Materials Research? Costly and less glamorous production research has been neglected but novel techniques are being developed for fabrication and screening of new materials. Discusses refractory metals, novel fabrication methods, slip casting of tungsten, gas plating, welding, new processing, iron whiskers, and unconventional methods. ***Arthur R. Lytle.*** *Missiles and Rockets*, v. 5, no. 14, Apr. 6, 1959, p. 30 + 4 pages.

8085* Martensitic White Irons for Abrasion-Resistant Castings. This paper deals with a number of the important characteristics of the martensitic white irons, together with studies on a number of the more important variables influencing their structure, wear resistance, mechanical properties, and resultant service life. ***T. E. Norman, A. Solomon, and D. V. Doane.*** *Modern Castings*, v. 35, Apr. 1959, p. 104-118.

8086* Investigation of Heterogeneity of Transformer Steel Ingot. (*In Russian.*) Issledovanie neodnorodnosti slitka transformatornoĭ stali. ***N. F. Dubrov, I. A. Gorlach, N. V. Keis, and D. G. Zhukov.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 117-122.

8087* Mastering Production of Dynamo Steel in 200-Ton Open-Hearth Furnaces. (*In Russian.*) Osvoenie vyplavki dinamnoĭ stali v 200-*t* martenovskikh pechakh. ***V. F. Agapov and I. A. Tkachenko.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 125-128.

8088* About the Mechanism of Influence of Magnesium on Quality of Steel. (*In Russian.*) O mekhanizme vozdeĭstviia magniia na stal'. ***I. A. Andreev and A. Ia. Borisov.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 131-136.

8089* The Nature of Fissures in IX18H9T Steel. (*In Russian.*) Priroda rvanin na stali IX18H9T. ***L. D. Kossovskii, V. A. Khorosh, and M. A. Mukhina.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 147-148.

8090* Tellurium in Steel. (*In Russian.*) Tellur v stali. ***Ia. E. Gol'dshteĭn.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 156-159.

8091* Titanium and Its Alloys in Aeronautical Construction. A study of the effects of beta forming additions, of different impurities such as oxygen, nitrogen, carbon, iron, hydrogen on titanium, and a survey of the additional metals mostly used such as aluminum, manganese, and molybdenum with a consideration of the foundry practices in relation to the alloys obtained. (*In French.*) Le titane et ses alliages en construction aéronautique. ***Pierre Vachet.*** *Technique et Science Aéronautiques*, 1958, no. 5, Oct., p. 221-241.

8092* Production Aids in the Use of Malleable Iron. Important properties of certain malleable irons are: ability to respond to localized hardening—either flame or induction; hardenability similar to low alloy steel, and in small sections suitable for full hardness when oil quenched; good wear resistance; and the ability to be formed by a number of operations unusable with other types of iron castings. ***William E. Hoffman.*** *Tooling & Production*, v. 25, no. 1, Apr. 1959, p. 44-46.

See also: **7354** (metals used in Vanguard rocket); **7355** (toolsteels for aircraft); **7838** (Japanese iron and steel industry); **7867** (high temperature technology review); **8484** (molten metal dyeing); **8496** (molybdenum welding).

METALS—CORROSION

8093 Initial Oxidation Rate of Nickel and Effect of the Curie Temperature. Nickel foil was oxidized for 24-hr. periods within the temperature range 307 to 442 C producing NiO films up to 3400 Å thick maximum. A discontinuity in oxide growth is observed at the Curie temperature (353 C). Data obtained at 390, 394, and 405 C as a function of time show that a two-stage oxide growth rate occurs, a higher rate following an initially lower rate. Both stages are represented by a linear relation between oxide thickness and logarithm of time. Many initial oxidation rate data obtained by other investigators, for Ni and a variety of metals, also follow the two-stage logarithmic equation. Based on control of the initial oxidation rate by electron transfer from metal to oxide, the discontinuity of oxide thickness at the Curie temperature is explained by an observed work function of nickel slightly higher above the Curie temperature than below. ***H. Uhlig, J. Pickett, and J. Macnairn.*** *Acta Metallurgica*, v. 7, Feb. 1959, p. 111-117.

8094 Anti-Corrosion Manual. 260 pp. 1958. Corrosion Prevention and Control, London. (TA462 An87 Vis.)

8095* Cathodic Protection of Heat Exchangers. Protection of condenser components is aided by a theoretical analysis of the mechanism of cathodic protection. ***C. Plumpton and C. Wilson.*** *British Chemical Engineering*, v. 4, Apr. 1959, p. 200-205.

8096 Tantalum 'Takes It' in Petrochemical Plant. Hydrochloric acid varying in concentration from 33 to 99% at temperatures to 250 F has been in service for seven years without corrosion of tantalum valve stems. *Chemical Processing*, v. 22, Apr. 1959, p. 82-83.

8097 Cobalt in Steels. What improvements may be expected. ***L. Habraken and D. Coutsouradis.*** *Cobalt*, no. 2, Mar. 1959, p. 11-22.

8098 The Corrosion of Iron and Its Prevention. A book for iron metallurgists and specialists, treating the subject of corrosion and corrosion protection of iron, including pure iron as well as technical iron materials. (*In German.*) Die Korrosion des Eisens und Ihre Verhütung. ***Heinrich Klas and Heinrich Steinrath.*** v. XIII. 504 pp. 1956. Verlag Stahleisen m.b.H., Düsseldorf, Germany. (TA467 K66k)

8099 A High-Temperature X-Ray Investigation on Niobium Pentoxide and Some Problems Concerning the Oxidation of Niobium. The phase transformations of niobium pentoxide have been investigated by means of high-temperature X-ray photography up to 1230 C. The total oxidation of initially pure niobium metal is followed in sequence, the isothermal stages extending from solid solution of oxygen in niobium to Nb_2O_5. ***H. J. Goldschmidt.*** *Institute of Metals, Journal*, v. 87, pt. 7, Mar. 1959, p. 235-239.

METALS—EXTRACTION AND REFINING

8100* On the Calculation of Slagging Furnaces. Theory is based on heat transfer by radiation between flame and wall, heat passing through the combustion chamber wall to the boiler heating surface, and the difference between the theoretical combustion temperature and the actual flame temperature. A diagram shows these and permits the calculation of the required volume of a slagging chamber for given conditions. (*In German.*) Zur Berechnung von Schmelzfeuerungen. ***Arthur Zinsen.*** *Brennstoff-Wärme-Kraft*, v. 11, Mar. 1959, p. 117-119.

8101 Longitudinal Panel Cracking in Ingots. Longitudinal panel cracks are, as the term suggests, a particular type of ingot crack appearing in a longitudinal direction on the face of an ingot. They may occur on one, two, or, very occasionally, three faces of the ingot and may extend over almost the entire length, in which case the whole of the ingot has to be scrapped. There are recorded instances where panel cracks have led to 60-70% of the ingots in a cast being scrapped, which obviously constitutes a most serious loss. ***S. C. Desai.*** *Iron and Steel Institute, Journal,* v. 191, pt. 3, Mar. 1959, p. 250-259.

8102 FluoSolids Roasting of Sulfides. Its Meaning to Japan's Economy. FluoSolids treatment of Yanahara pyrrhotite has given Japan's Dowa Mining Company a profitable return on copper, sulfuric acid, and iron ore. This means a material increase in the country's natural resources. ***Hidesaburo Kurushima and R. M. Foley.*** *Journal of Metals,* v. 11, Mar. 1959, p. 173-174.

8103 Slag Recovery at Yawata Works. Economics of steel production in Japan are such that this large producer has found means of utilizing some two-thirds of its open-hearth slag. ***Kamekichi Wada.*** *Journal of Metals,* v. 11, Mar. 1959, p. 187-188.

8104 The Refining of Uranium in the United Kingdom. ***D. P. Hamilton.*** *Nature,* v. 183, Mar. 21, 1959, p. 786-787.

8105* Terminal Zone Cropping and Ultimate Zone Purification. An aspect of zone melting which apparently has not been reported on as yet, concerns the explicit degree of purification achieved after any number of passes. A rather fundamental parameter, termed the purification factor, was introduced several years ago to identify the potential state of purity achieved in an ingot at any stage of the zone refinement process. ***Louis Gold.*** *Physical Society of Japan, Journal,* v. 14, Mar. 1959, p. 386.

8106* Distribution of Gas Flow in Blast-Furnace Shaft. (*In Russian.*) Raspredelenie gazovykh potokov v shakhte domennoĭ pechi. ***N. N. Babarykin.*** *Stal',* v. 19, no. 2, Feb. 1959, p. 101-105.

8107* An Experience in Converting 400-Ton Open-Hearth Furnace to Firing With Sulfurous Fuel Oil. (*In Russian.*) Opyt perevoda 400-t martenovskoĭ pechi no sernistyĭ mazut. ***F. D. Voronov, E. I. Dikshteĭn, K. A. Zuts, and A. G. Trifonov.*** *Stal',* v. 19, no. 2, Feb. 1959, p. 112-116.

8108* Perfection of Surface Quality of Rimming Steel Ingot. (*In Russian.*) Uluchshenie kachestva poverkhnosti kipiashchego slitka. ***A. G. Nikolaev, Z. I. Riabov, P. G. Chernogrud, and D. K. Pugachev.*** *Stal',* v. 19, no. 2, Feb. 1959, p. 123-124.

8109* The Design Development of Partition Wall for Slag Pockets. (*In Russian.*) Uluchshenie konstruktsii razdeliteľnoĭ steny shlakovikov. ***M. A. Kovshar'.*** *Stal',* v. 19, no. 2, Feb. 1959, p. 128-129.

8110 The Production of Thorium Metal. In this paper, the processes used for the production of reactor grade thorium metal fuel elements from thorium nitrate are reviewed. The quality of raw materials and the quality of the metal product are briefly described. Important operating techniques are emphasized. ***O. R. Magoteaux.*** *U. S. Atomic Energy Commission, BNL-483* (C26), Jan. 9-10, 1958, p. 87-90. (UF767 Un3.1bn Contin.)

8111 Preparation of Thorium Metal by Calcium Reduction of Thorium Oxide. The purpose of this project was to produce a quantity of thorium metal that could be hydraulically pressed into electrodes. These electrodes would then be arc-melted to form an ingot suitable for rolling and machining. Direct extrusion or swaging of pressed bars into rods was also considered a possibility. Adoption of this process looked favorable from an economic standpoint if the entire process were proven to be feasible. ***S. Cseplo and J. O. Davis.*** *U. S. Atomic Energy Commission, BNL-483* (C26), Jan. 9-10, 1958, p. 101. (UF767 Un3.1bn Contin.)

8112 Thorium Production by the Sodium Amalgam Reduction of Thorium Tetrachloride. The reduction of thorium tetrachloride by sodium in a mercury medium has many advantages in producing reactor grade thorium economically. Because small sponge billets were not consistently well bonded by hot-pressing and direct extrusion and because arc-melting produced purer metal, the recommended procedure for consolidation of sponge billets to rod is arc-melting followed by extrusion. ***O. C. Dean.*** *U. S. Atomic Energy Commission, BNL-483* (C26), Jan. 9-10, 1958, p. 102-108. (UF767 Un3.1bn Contin.)

8113 Thorium Alloy Systems. Much work has been done over a period of years on thorium alloy constitution. While little work has been done recently on thorium for reactor use, there has been some progress in our knowledge of its alloys. ***F. A. Rough.*** *U. S. Atomic Energy Commission, BNL-483* (C26), Jan. 9-10, 1958, p. 124-125. (UF767 Un3.1bn Contin.)

See also: **7877** (carbon consumption and blast furnace heat); **8344** (direct reduction of iron ore); **8357** (oxidized sintering of iron ores).

METALS—FINISHING, POLISHING, AND CLEANING

8114 Finishing Handbook and Directory 1959. ***C. S. Woollard, editor.*** 508 pp. 1959. Sawell Publications Ltd., London. (T12 G7fi Vis.)

8115* Developments in Metal Pre-Treatment. The special requirements of one-coat finishes and acrylic paints can be met by thin, smooth phosphate coatings. Recent work has shown that phosphate coating refinement can be obtained by modification of the processing solutions with polyphosphates or inhibitors. Details of the peroxide accelerated zinc phosphate process are given with particular reference to the car industry. The use of thin iron phosphate coatings for strip steel and other applications is described. New control methods and improved designs prevent rinse water blistering of paint in large installations and a solvent drying process is now available for the immersion treatment of plated or phosphated articles to eliminate water marks and rinse water contamination. Alkaline derusting processes find particular application for the treatment of high tensile steels to avoid hydrogen embrittlement and for components which must not be subjected to any loss of metal. Developments in the treatment of aluminium are given with particular reference to the aircraft industry. The expanding uses for chromate films on zinc and aluminium for corrosion prevention are described. ***R. E. Shaw.*** *Institute of Metal Finishing, Transactions,* v. 36, pt. 3, Spring 1959, p. 107-112.

8116* New Method of Pickling Tubes of High-Alloy Steels. Acid pickling method gives light-gray color and smooth surface on tubes quickly and with minimum metal losses, without overpickling, pitting, or corrosion fissuring of the surface layer. (*In Russian.*) Novyĭ sposob travleniia trub iz vysokolegirovanykh staleĭ. ***N. V. Bogoiavlenskaia and Ia. N. Lipkin.*** *Stal',* v. 19, no. 4, Apr. 1959, p. 347-351.

See also: **7464** (amphoteric detergents in metal cleaning); **8205** (nature of mechanically polished surfaces).

METALS—FOUNDRY PRACTICE

8117 Better Alloys and Purer Metals From Electron-Beam Furnace. The new technique has demonstrated it can produce high-purity tantalum in 3-in.-dia ingots (100 lb) and molybdenum in 5-in. ingots. Other difficult materials such as zirconium, columbium, titanium, and tungsten can also be melted and purified. *American Machinist,* v. 103, Mar. 23, 1959, p. 134-135.

8118* Resin and Sand Economy, and Surface Finish in Shell Molds. The paper shows how material costs in the shell-molding process might be reduced by reclaiming the sand, the use of pickup agents, and the use of precoated sand. The cold

strengths of test pieces made by blowing into a heated mold were measured using various resin-sand mixtures prepared from silica, zircon, or olivine sands and a resin of the "100% phenolic" type, or of precoated sands obtained commercially. Shells made from all mixtures of resin and sand imparted a better surface finish to castings in phosphor bronze than did molds made from Mansfield sand; zircon-sand shells gave the best surface finish. ***R. S. Jackson and W. W. Glick.*** *British Foundryman*, v. 52, Feb. 1959, p. 53-61.

8119* The Effect of Mould Material on the Cooling Rate and Physical Properties of Cast Metals. The results of the tests confirm the previous experimental work and show that increased coarseness of grain size and increased mold density increases tensile strength in all cases, when other variables are equal. The exception to this was found when the test casting was not of sufficient volume to avoid being mottled when the cooling power of the mold material was increased. The conclusions reached in this report may assist in elucidating certain phenomena encountered in foundries which have previously remained unexplained. The report also sets out some variables which must be controlled when investigations into cooling rates of castings are carried out. *British Foundryman*, v. 52, Feb. 1959, p. 66-79.

8120* Recent Developments in Centrispinning High-Alloy Steels and Other Materials. The present paper refers in particular to the physical and metallurgical characteristics of a range of high-duty components produced by the centrispinning process in high-alloy steel and nickel-base compositions. Brief reference is also made to the influence of basic compositions upon the casting properties of this complex series of steels and alloys as affecting operational procedure and control necessary for the maintenance of quality. ***A. E. Thornton.*** *British Foundryman*, v. 52, Feb. 1959, p. 80-90.

8121* The Running and Gating of Copper-Alloy Castings. The flow of copper alloys through channels in shell molds and in green-sand molds is compared, and graphs are presented showing the dimensions of tapered sprues required for a given flow rate of copper or aluminium. ***W. W. Glick, R. S. Jackson, and R. W. Ruddle.*** *British Foundryman*, v. 52, Feb. 1959, p. 90-107.

8122 Factors Affecting Sodium Silicate-Bonded Sands. Suggestions are made for proper sand mixes, CO_2 gassing time and the use of washes, vents, and rods to control green and retained strength, metal penetration, gas evolution, and distortion. ***R. E. Morey and E. A. Lange.*** *Foundry*, v. 87, Apr. 1959, p. 188 + 5 pages.

8123 Effect of a Metal Stream on the Inner Surface of a Sand Mould. Effects are dealt with under three main headings: Impact—Rinsing—Heat Radiation. Using the results, an attempt has been made to classify molding materials which are in current use in foundries into grades of "surface durability". ***J. Szreniawski.*** *Foundry Trade Journal*, v. 106, Mar. 19, 1959, p. 323-330.

8124* The Importance of the Induction Melting Furnace for the Foundry. Physical fundamentals; furnace types; metallurgy; applications in the foundry. (*In German.*) Die Bedeutung der Induktionsöfen für die Giesserei. ***Karl-Heinz Brokmeier.*** *Giesserei*, v. 46, no. 6, Mar. 12, 1959, p. 129-136.

8125* Experiences Made in the Operation of 8-Ton Mains Frequency Induction Crucible Furnace. Rammed lining and charge; electrical equipment. (*In German.*) Betriebserfahrungen mit einem 8-t-Netzfrequenz-Induktionstiegelofen. ***Heinrich Rosenberg and Willi Dobber.*** *Giesserei*, v. 46, no. 6, Mar. 12, 1959, p. 136-137.

8126* Study on the Melting Loss in Melting Brass Scrap Using 50% of Brass Chips as Charging Material. Mode of operation; methods of testing; test results. (*In German.*) Über Abbrandverhältnisse beim Schmelzen von Messingschrott unter Verwendung von 50% Messingspänen als Einsatzmaterial. ***Manfred Stammler.*** *Giesserei*, v. 46, no. 6, Mar. 12, 1959, p. 138-139.

8127 Laboratory Equipment for the Melting and Casting in Vacuum of Pure Iron and Iron Alloys. Developing a relatively simple method to prepare up to 2 kg of a metal that does not contain more than 0.030% of total impurities and in which a determined amount of alloying element can be incorporated. Two hundred small ingots of iron and alloys were prepared. (*In French.*) Appareillage de laboratoire pour la fusion et la coulée sous vide de fer pur et d'alliages de fer. ***M. Olette and A. Chaillou.*** *Institut de Recherches de la Sidérurgie, Publication*, ser. A, no. 215, Mar. 1959, p. 117-187. (TN602 In7p Vis.)

8128 Equipment and Practice for Continuous Casting and Rolling by the Properzi Process. The construction and operation of the Properzi machine are described. ***James B. Russell and Frank R. Nichols.*** *Institute of Metals, Journal*, v. 87, pt. 7, Mar. 1959, p. 209-219.

8129 The Hazelett and Rotary Strip-Casting Machines for the Continuous Casting of Aluminium. A brief review of early methods of continuous casting with the aid of moving molds. The Hazelett and Rotary Strip Casting machines. ***R. D. Hamer.*** *Institute of Metals, Journal*, v. 87, pt. 7, Mar. 1959, p. 219-226.

8130* The Theory of the Formation of Hot Tears. (*In Russian.*) *K teorii obrazovaniia goriachikh treshchin. V. N. Saveiko. Inzhenerno-Fizicheskii Zhurnal*, v. 2, no. 2, Feb. 1959, p. 79-85.

8131* The Dissolution of Globular Graphite Inclusions in Magnesium Cast Iron. (*In Russian.*) Rastvorenie vkliuchenii globuliarnogo grafita v magnievom chugne. ***L. A. Shevchuk.*** *Inzhenerno- Fizicheskii Zhurnal*, v. 2, no. 2, Feb. 1959, p. 103-106.

8132 Vacuum Treatment of Steel by the Bochumer Verein Stream Degassing Process. A new method of degassing steel is described which has the main advantage of reducing hydrogen contents and thus producing flake-free forgings. The low total oxygen and inclusion content of the vacuum-treated steel leads to an improvement in toughness. The method can be applied to the degassing of large quantities of steel and to the production of small ingots of high-alloy steels. It has been in use at the Bochumer Verein since 1952 for all heavy forging ingots. ***A. Tix, G. Bandel, W. Coupette, and A. Sickbert.*** *Iron and Steel Institute, Journal*, v. 191, pt. 3, Mar. 1959, p. 260-265 .

8133 Vacuum-Induction Melting. A brief history of vacuum-induction melting is given and the equipment required for large-scale operation, including a 5000-lb furnace, is described. Basic principles of the process are discussed and examples are given of improvements obtained in the physical properties of high-temperature alloys and certain steels. ***F. N. Darmara, J. S. Huntington, and E. S. Machlin.*** *Iron and Steel Institute, Journal*, v. 191, pt. 3, Mar. 1959, p. 266-276.

8134 Japanese Research on Physical Chemistry of Steelmaking. Briefly summarizing the work of Japanese investigators on this important aspect of metallurgical technology. ***Tasuku Fuwa.*** *Journal of Metals*, v. 11, Mar. 1959, p. 170-172.

8135 LD Steelmaking in Japan. Although it is only one year since the LD process was first put into operation in Japan, four converters are already in operation, and by the end of 1962, the LD process will account for one quarter of Japan's total ingot capacity. ***Kaname Mochizuki.*** *Journal of Metals*, v. 11, Mar. 1959, p. 178-180.

8136 Bessemerizing the Blast-Furnace Bath. ***Kuro Kanamori.*** *Journal of Metals*, v. 11, Mar. 1959, p. 184-186.

8137 Air-Cooled Crucibles for Cold-Mold Arc Melting. Forced-air cooling has been applied experimentally at the U.S. Federal Bureau of Mines Station, Albany, Oregon, to the cold-mold arc melting process used with zirconium and other reactive metals. Development work has indicated that a copper crucible with narrow, closely spaced, longitudinal slots in its outer surface represents the best general design, that such units are practicable in sizes corresponding to those of water-cooled units, and that they can be operated at comparable power levels. *Metal Industry*, v. 94, Mar. 13, 1959, p. 206.

8138 Operational Factors in Die-Casting. In this article, which has been specially translated for *Metal Industry*, the author distinguishes four operational variables as mainly deter-

mining the characteristics of diecast components. These are injection pressure; injection temperature; die temperature and injection velocity. The manner in which each of these affects tensile strength is discussed and the results are shown in graphs. Approximate means of varying velocity of injection on Polak die-casting machines are suggested. ***P. P. Moskvin.*** *Metal Industry*, v. 94, Mar. 13, 1959, p. 207-209.

8139 Trends in Production of Castings in Aluminium Alloys. For the production of castings in aluminum alloys, there is a definite trend from sand casting to gravity die casting, and from gravity die casting to pressure die casting. The author discusses the technical and economic considerations involved and emphasizes the importance to the aluminium foundry industry of cooperation with the designer to ensure that the best design, alloy and process are used for each particular casting. ***A. P. Fenn.*** *Metallurgia*, v. 59, Feb. 1959, p. 63-66.

8140* Green Tensile and Shear Strengths of Molding Sands. Their relation to other green sand properties and their connection with molding problems are discussed. ***R. W. Heine, E. H. King, and J. S. Schumacher.*** *Modern Castings*, v. 35, Apr. 1959, p. 91-98.

8141 Why You Should Use Standard Alloys When Designing for Investment Casting. Because any castable metal or alloy can be investment cast, some designers at times tend to select the more rarely used materials. These materials may give unique properties within a limited area. However, they slow down production of the castings and increase part costs. Since many of these materials are seldom used, the foundry has usually had only limited experience with them. This can lead to high initial rejects due to improper founding methods. *Precision Metal Molding*, v. 17, Apr. 1959, p. 39-41.

8142 When Designing for Permanent Mold Castings Use These Properties of Permanent Mold Casting Alloys. Permanent mold casting offers the designer all of the advantages of sand casting in choice of alloy. It permits as great, or greater flexibility of coring, gives a stronger, sounder casting with a far superior surface finish and much closer dimensional accuracy. The reproducibility, from casting to casting is much better than can be secured in sand and, because of greater as-cast accuracy, much less machining allowance is needed. *Precision Metal Molding*, v. 17, Apr. 1959, p. 42 + 3 pages.

8143 Technical Reference File. Approximate Comparative Properties of Various Commonly Cast Materials. *Precision Metal Molding*, v. 17, Apr. 1959, p. 46.

8144* Operation of Hot Metal Ladle Cars at Blast-Furnace Plant of the Magnitogorsk Metallurgical Combine. (*In Russian.*) Ekspluatatsiia chugunovoznykh kovshei v demennom tsekhe MMK. ***G. I. Gerasimov, F. A. Korablin, V. M. Nemkin, and V. A. Lednov.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 110-111.

8145 Bessemers Used at Lorain to Make Leaded Steel. Three welded shell acid bessemer converters are used to make leaded steel in 60 ton heats. *Steel*, v. 144, Mar. 30, 1959, p. 82, 84.

See also: **7836** (growth of foundry industry).

METALS—HEAT TREATMENT

8146 Stress-Relief of Aluminum for Aircraft. Use of machined components instead of assemblies in aircraft has led to much research on stress-relief processes. Stretching, cold forging, and skin-pass rolling are successful, in descending order, in relieving stresses in heat treated aluminum alloy plates. ***R. T. Myer, S. A. Kilpatrick, and W. E. Backus.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 112 + 4 pages.

8147 AM350 and AM355 . . . Properties and Heat Treatment. Two new high-strength stainless steels have similar compositions but different properties. Chromium and carbon are adjusted so that one grade contains delta ferrite while the other is completely martensitic. Both steels are readily formed when annealed; heat treatment imparts high strength with good ductility at room and elevated temperatures. ***R. A. Lula.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 116-120.

8148 Cold Treatment for Better Properties. Chilling of heat treated steel parts to −120 F transforms retained austenite to martensite. Commercial refrigerating units are doing this today on a wide variety of parts. ***Rolland S. Jamison.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 128-130.

8149* Automatic Flame-Hardening Techniques. Heat-Treat Giant Excavator Components. Working parts of earth-moving excavators are subject to considerable wear by abrasion of grit and mud, and must have hard, tough wearing surfaces. At the Lincoln works of Ruston-Bucyrus, Ltd., which is equipped for building excavators weighing from 2 to 200 tons at the rate of 1,400 units a year, automatic flame-hardening plant has been installed for heat-treating odd-shaped and heavy components. *Metalworking Production*, v. 103, no. 12, Mar. 20, 1959, p. 491-493.

8150* Heat Treatment of Ductile Iron. Heat treatment on a tonnage basis is considered. Three types of treatment: first, a full ferritizing anneal; second, a subcritical draw for machinability retaining the "as cast" tensile properties; and third, a two temperature normalizing in the interests of machinability for small castings furnished against the "as cast" specifications. ***W. D. McMillan.*** *Modern Castings*, v. 35, Apr. 1959, p. 77-78.

8151 Reference Values for the Heat Economy in Iron and Steel Plants. A revised and enlarged edition written for metallurgists and covering the following subjects: fuels, especially oil fuels, ore treatment, foundry melting, rolling mills, purification and dust removal of gases and air, the human element in work. (*In German.*) Anhaltszahlen für Die Wärmewirtschaft in Eisenhüttenwerken. 5th Ed. 472 pp. 1957. Verlag Stahleisen M.B.H., Düsseldorf, Germany. (TN705 V58a5)

8152* Production of Protective Atmosphere for Bright Annealing. (*In Russian.*) Proizvodstvo zashchitnoĭ atmosfery dlia svetlogo otzhiga. ***F. I. Zenchenko and Ia. A. Peker.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 151-155.

8153* Acceleration of Coiled Steel Annealing by Using Helium. (*In Russian.*) Uskorenie otzhiga rulonnoĭ stali primeneniem geliia. ***Kh. Sh. Levinzon.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 165-166.

8154 Increasing the Durability of Forming Dies for Ceramic Parts. Describes technology for nitriding the working surfaces of forming dies for pressing parts from powders. For hardening and tempering, the dies were heated to 1080 C, cooled in oil, again heated to 650 C, soaked for 2 hours, and then cooled in air. (*In Russian.*) Povysheniie stoĭkosti press-forms dlia pressovaniia metallokeramicheskikh deteleĭ. ***I. V. Trush and V. A. Sechko.*** *Stanki i Instrument*, v. 30, no. 2, Feb. 1959, p. 39.

See also: **8521** (welding of rocket cases).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

8155 Recent Survey of Current Activities on Fatigue. A report of subcommittee III on survey of ASTM committee E-9 concerning recent activities in the field of fatigue. Copies were sent to approximately 180 universities, research institutes, government laboratories, and industrial laboratories known to be interested in the field. About 50 laboratories reported some 161 programs under way. The titles of these projects are listed. ***Horace J. Grover.*** *ASTM Bulletin*, no. 235, Jan. 1959, p. 26-29.

8156 A Machine for Evaluation of High-Temperature Alloys Under Combined Static and Dynamic Stresses. A resonance type of testing machine has been developed to serve as an aid in the development of new high-temperature alloys. The machine subjects the specimen to a static or stress-rupture loading combined with a high-frequency fluctuating stress, to

simulate service loadings typical of highly stresssed components such as gas turbine buckets, wheel materials, combustion chamber liners, and the like. The test temperature range is from 1000 to 1800 F. Results of tests on two high-temperature alloys, A286 and GMR235D, are included to illustrate the utility of the machine. Data are presented as modified Goodman type diagrams as well as three-dimensional diagrams incorporating axes of static loading, dynamic loading, and time. ***Paul E. Hawkes and C. Harold Ek.*** *ASTM Bulletin*, no. 235, Jan. 1959, p. 46-51.

8157* Why Metals Fail. Long-Range Studies in the Metallurgy School, University of Melbourne. General discussion of brittle fracture, fatigue failure, creep, and forms of intercrystalline cracking. *Australasian Engineer*, 1959, Feb. 7, p. 45-53.

8158 Commentary on Industrial Needs for Fundamental Knowledge. Much more should be known about the behavior of O and oxidizing systems. In the steelmaking systems, more should be known concerning the O in slags and reactions between O and other gas phases. The role of O in steelmaking furnaces is not as well understood as the role of O in the blast furnace. ***M. Tenenbaum.*** Paper from "The Physical Chemistry of Steelmaking", p. 234. 1958. The Technology Press of the Massachusetts Institute of Technology and John Wiley & Sons, New York. (TN730 C76p Over.)

8159* How to Gauge Effect of Creep. Nonelastic elongation or stretch of an overhead conductor may be produced rapidly by loading of ice, snow, and wind; or gradually, over a long time, without significant increase in loading. The gradual stretch is referred to as creep. Regardless of how produced, nonelastic stretch increases the sag in the span, as compared with the installed sag. To assure that clearance is satisfactory, both causes of increased sag should be considered. Data presented are based on laboratory tests at room temperatures, and many findings have been proved on outdoor spans within usual temperatures. ***George H. Phillips.*** *Electrical World*, v. 151, Mar. 9, 1959, p. 56 + 2 pages.

8160 Are Metallic Meteorites a Key to the Re-Entry Problem? Even the fastest missile seems relatively sluggish when compared to the cruising speed of the average meteorite. Metallic meteorites help to spell out the magnitude of high-velocity space travel—especially the re-entry problem. Here are some of the interesting facts they have to tell. The microstructure of the Grant meteorite shows a prevalence of alpha iron. These grains are surrounded by white bands of gamma iron. Aerodynamic heating causes microstructural changes in metallic meteorites. Above are changes noted in Costilla Peak meteorite. Such changes can be simulated with laboratory heat treating equipment. A lamellar deposit appears on the trailing edge of the Costilla Peak meteorite. Metal froze where aerodynamic heating was milder. From the standpoint of aerodynamic design, irregularly shaped, iron-nickel meteorites leave a lot to be desired. Far more appropriate materials could be chosen for high velocity re-entry. But meteorites still contribute by underlining the severity of the problem with which our designers are faced. ***R. E. Maringer and G. K. Manning.*** *Iron Age*, v. 183, no. 15, Apr. 9, 1959, p. 93-96.

8161 Defects in Steel: A Tentative Theory. A statistical survey of the defects occurring in a total of over 1000 heats of basic semikilled plate steels has been made during three periods over several years. The influence of different modes of refining on "bath condition" are considered and emphasis is laid on the importance of the slag as the governing factor in the production of quality steel. ***T. F. Pearson.*** *Iron and Steel Institute, Journal*, v. 191, pt. 3, Mar. 1959, p. 219-231.

8162 The Texture and Mechanical Properties of Iron. An investigation has been made of the substructure developed in pure iron by deformation in tension at temperatures in the range −77 to +500 C. The flow stress on subsequent straining at room temperature is related to the substructure. ***C. J. Ball.*** *Iron and Steel Institute, Journal*, v. 191, pt. 3, Mar. 1959, p. 232-236.

8163 The Influence of Sulphur and Oxygen in Causing Red-Shortness in Steel. The influence of thermal history on red-shortness in steels containing 0·02-0·08% S, < 0·01-0·09% Mn, and high carbon contents (up to 0·8% C) was studied by means of impact-testing. Sulfur was found to cause red-shortness in two distinct ways: (a) by hardening the austenite, and (b) by forming intergranular sulfide precipitates. Both phenomena lead to intercrystalline fracture and one or both may be eliminated by heat-treatment, as is demonstrated for a steel with 0·076% S. Manganese counteracts red-shortness by (a) reducing the S solubility in austenite and hence its hardening potentiality, and (b) by preventing the formulation of embrittling grain-boundary sulfides. Tests with iron low in S and Mn and containing up to 0·035% O indicated that oxygen alone does not induce red-shortness. ***A. Josefsson, J. Koeneman, and G. Lagerberg.*** *Iron and Steel Institute, Journal*, v. 191, pt. 3, Mar. 1959, p. 240-250.

8164 Dispersion Strengthened Alloys: The Possibilities for Light Metals. During the past decade, the process of strengthening metals by means of a highly dispersed hard phase has gained widespread attention. Of particular interest is the fact that in several metals, notably of the light metal group, remarkably stable high-temperature properties can be obtained thanks to the strengthening action of the dispersed phase. Reports results achieved with dispersion alloys of copper, nickel, molybdenum, and other metals suitable for high-temperature applications. ***Claus G. Goetzel.*** *Journal of Metals*, v. 11, Mar. 1959, p. 189-194.

8165 PH15-7 Mo—More Strength at Elevated Temperatures. Addition of 2% Mo to 17-7 PH greatly enhances the mechanical properties of the original stainless steel. The new stainless, known as PH15-7 Mo, can withstand up to 1000 F in jet airframes and missiles. ***M. W. Marshall and Harry Tanczyn.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 121-125.

8166* Electrical Conductivity of Sand-Cast Copper-Base Alloys. Conductivities of over 100 various sand-cast copper-base alloys have been determined. The standard American Society for Testing Materials cast copper-base alloys, plus many other cast copper-base alloys. ***D. G. Schmidt and F. L. Riddell.*** *Modern Castings*, v. 35, Apr. 1959, p. 69-76.

8167* Radiography, Microstructure and Mechanical Properties of Cast Magnesium—Thorium—Zirconium Alloy HK 31A. Radiographs of cast HK31A magnesium parts exhibit sweeping dark lines, light areas of both circular and angular outline, light areas similar in shape to shrinkage cracks, and mottled or banded areas. These indications are excellent evidence of macrosegregation in the castings. An evaluation of the effect of this segregation on the mechanical properties of the cast material was essential to continued use of the cast parts. Several castings were selected on the basis of X-ray indications to be cut into tensile specimens representative of the segregation conditions. ***T. R. Bergstrom and R. G. Bassett.*** *Modern Castings*, v. 35, Apr. 1959, p. 79-87.

8168 The Effect of Grain Size on the Tensile Properties of High-Purity Molybdenum at Room Temperature. The room temperature yield and fracture stresses have been measured for a series of high-purity polycrystalline molybdenum tensile specimens with grain diameters varying from 0.03 mm to 0.26 mm. The yield stress results can be fitted to Petch's relation $\sigma_Y = \sigma_1 + k_Y l^{-1/2}$ with $\sigma_1 = 11.0$ kg mm^{-2} and $k_Y = 1.7 \times 10^4$ dyne cm$^{-3/2}$. Using a theory of fracture recently proposed by Cottrell, the effective surface energy for fracture is estimated to be 12,000 ergs cm^{-2}. ***A. A. Johson.*** *Philosophical Magazine*, v. 4, ser. 8, Feb. 1959, p. 194-199.

8169 The Fatigue of Metals at 1.7°K. ***R. K. MacCrone, R. D. McCammon, and H. M. Rosenberg.*** *Philosophical Magazine*, v. 4, ser. 8, Feb. 1959, p. 267-268.

8170 The Physical Metallurgy of Magnesium and Its Alloys. Discusses the physical and theoretical background of the technology of magnesium and its alloys. The first part deals with the fundamental nature of magnesium, its electronic constitution, and the effects of alloying. The theories of solid solubility limits, liquidus curves, intermetallic compound formation, lattice spacing variations, and general inter-relationships between the intermediate phases are discussed. The second part describes and discusses the alloy systems formed by magnesium, emphasis being laid on those of present or potential importance. Rare earth additions are also mentioned. ***G. V. Raynor, editor.*** 514 pp. 1959. Pergamon Press, New York. (TN693.M3 R21p)

8171 When Designing for Die Casting, Use These Properties of Die Casting Alloys. *Precision Metal Molding*, v. 17, Apr. 1959, p. 36-39.

8172 Technical Reference File. Properties of Extruded Alloys—Table VIII. *Precision Metal Molding*, v. 17, Apr. 1959, p. 47.

8173 Technical Reference File. Ferrous and Non-Ferrous Powdered Metal Densities (Factor Easily Computes Lbs. per thousand pieces From Volume of Part in Cubic Inches.) Density. Per cent of wrought material. *Precision Metal Molding*, v. 17, Apr. 1959, p. 48.

8174 Controlled Explosive Blasts Hardness Into Steel. A new technique has turned up as rival to the conventional methods of workhardening castings made from high-manganese steel. The technique hardens the material explosively–but with a carefully controlled blow. There is practically none of the usual plastic deformation that occurs when hardening is done by pressing or hammering. The relatively simple new method results in deeper hardening than attainable by cold deformation of the newly cast part or by cold working attained in service. The technique is called velocity-impact hardening (VIH)—it is not the impact itself but the shock waves that do the work. They transform the soft, ductile austenitic steel by stressing it internally—making it strong, tough, and wear-resistant. The material is microscopically indistinguishable from the product obtained by cold working methods. ***W. A. Harper.*** *Product Engineering*, v. 30, no. 15, Apr. 13, 1959, p. 62-63.

8175 Aligned Crystals in Metals. Crystals have different properties in different directions. Alignment of the crystal grains within a piece of metal can significantly alter its mechanical and magnetic behavior. Discusses preferred grain orientation, and fibrous structures, directionality and texture of metals. Also mentions improvements obtained in silicon iron, magnetic materials, and fiber texture obtained in uranium fuel elements. There apparently is no reason why particular fiber textures cannot be obtained that will give wire and rod better strength and elasticity than they now have. ***B. D. Cullity.*** *Scientific American*, v. 200, no. 4, Apr. 1959, p. 125 + 8 pages.

8176* Structural Stability and Properties of Heatproof Chrome Steels. (*In Russian.*) Stabil'nost struktury i svoĭst' teploustoĭchivykh khromistykh staleĭ. ***A. V. Merlina and A. M. Borzdyka.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 160-165.

8177* Heterogeneity of Magnetic Properties of Cold-Rolled Transformer Steel. In order to prevent formation of fine-grained non-textured sections of metal with inferior magnetic properties, it is necessary to strive for an effective elimination of nonmetallic inclusions and to attain as far as possible the complete decarburization of steel during various stages of its treatment. (*In Russian.*) Neodnorodnost' magnitnykh svoĭstv kholodnokatanoĭ transformatornoĭ stali. ***A. G. Petrenko, L. A. Kurtova, M. M. Petliakov, and A. I. Beliakov.*** *Stal'*, v. 19, no. 3, Mar. 1959, p. 267-268.

8178 A System for Automatic Processing of Fatigue Data. Presents and discusses a system for coding of fatigue information on IBM cards for subsequent automatic processing of the data. Certain codes are needed for some types of entries; the design and preliminary development of these codes are included. The card system will permit coding not only the basic fatigue information (stress and lifetime) but also pertinent information describing (1) basic material and fabrication (2) mechanical properties of the material (3) specimen design and preparation methods, and (4) type of test and associated testing procedure. ***A. J. Belfour and W. S. Hyler.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-461, Jan. 1959, 189 pp. (TL507 Un3.18w Vis.)

8179 Evaluation of Alloys for High Temperature Gear Applications. The selection of materials for use in high Mach number aircraft gears requires consideration of high temperature physical, mechanical, and chemical properties, and of rubbing compatibility. This program was designed to obtain bench test data on ten different materials for application as gears at operating temperatures to 700 F. Oils representing two important classes, silicone and mineral, were chosen for scoring tests. High temperature data were obtained on hardness, dimensional stability, tensile, impact and tooth fatigue strengths, corrosion and oxidation, and on surface scoring resistance. The most fatigue resistant material was Modified M50, Carburized, while Matrix M2 was the best of the through-hardened steels. In score resistance, the best material depended on the oil; L.P.D. (Vacuum), Nitrided was the best with silicone, but Ml rose from second place with silicone to first with mineral oil. Choice of material for any application must depend on whether tooth breakage or scoring is the limiting factor; however, the L.P.D. (Vacuum) Nitrided is the best compromise since it ranked high in all tests. ***E. G. Jackson, C. F. Muench, E. H. Rowe, and E. H. Scott.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-546, Dec. 1958, 79 pp. (TL507 Un3.18w Vis.)

8180 Damping Capacity—Its Measurement and Significance. This report was prepared as a background reference for future publications concerning the damping capacity of metals and alloys. It contains a broad description of the theory and methods of measuring damping capacity and correlates the developments of the past decade in terminology, units, and techniques. The bibliography contains over 150 references to recent articles, each tabulated as to material investigated and test variables, such as frequency, stress, mode of vibration, and temperature. The employment of damping capacity as a research tool in metallurgy has been expanded rapidly. Transformations that result in modifying the internal structure or constitution of a material may cause marked changes in its vibration properties. When data on these properties are combined with data on tensile strength, yield strength, hardness, electrical resistivity, and metallography, damping capacity has proved to be a very useful analytical quantity in metallurgical research. ***J. W. Jensen.*** *U. S. Bureau of Mines Report of Investigations* 5441, 1959, 46 pp. (TN21 Un3r Vis.)

8181 Study of Plastic Deformation in Binary Aluminum Alloys by Internal-Friction Methods. The damping capacity of several Al-Cu alloys has been investigated during tensile elongation. This damping is shown to depend on strain rate, strain, temperature, alloy content, and heat treatment. A tentative hypothesis, based on the acceleration of solute atom diffusion by deformation-produced vacancies, is proposed to account for the observed behavior. Internal-friction maxima are observed in deformed Al and Al-Cu alloys at −70 and −50 C. The peaks appear to be relatively insensitive to frequency and alloy content, but they disappear after annealing at temperatures nearing the recrystallization temperature. ***E. C. Olson, R. E. Maringer, L. L. Marsh, and G. K. Manning.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 3-3-59W, Mar. 1959, 31 pp. (TL782 Un3rm Vis.)

See also: **7353** (properties of alloys for rockets and missiles); **8208** (properties of Ti alloys).

METALS—MECHANICAL WORKING

8182* Cavity Formation and Enfolding Defects in Plane Strain Extrusions Using a Shaped Punch. Expressions are obtained for a best upper bound to the load necessary to cause extrusion through square dies, under conditions of plane strain, using a punch face which is inclined to the axis of the extrusion container. The results are interpreted to suggest how, for a given reduction, that angle of punch face may be chosen which delays the onset of cavity deformation. The modes of deformation considered suggest the mechanism whereby the oxide layers on the rear of a billet may become entrained down the center of an extruded product. ***W. Johnson.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods*, v. 8, nos. 2-3, 1959, p. 228-236.

8183* What You Should Know About Planing With Carbides. III. Tool Geometry. ***Harold W. Knox.*** *Carbide Engineering*, v. 11, Apr. 1959, p. 19-24.

8184 High-Productivity Milling Cutters. ***O. Ya. Konstantinov.*** *Engineers' Digest*, v. 20, Mar. 1959, p. 109-110. (Translated from *Mashinostroitel, Russia*, no. 1, Jan. 1959, p. 37-40.)

8185 Motion-Picture Technique for Studying Grinding Phenomena. ***K. E. Schwartz.*** *Engineer's Digest*, v. 20, Mar.

1959, p. 115-117. (Translated from *Industrie-Anzeiger*, v. 80, no. 92, Nov. 18, 1958, p. 1391-1395.)

8186* Long Range Outlook for Man-Made Diamonds. Cutting tests to determine the comparative value of man-made diamonds in relation to natural diamonds. ***Chester A. Nisula.*** *Machine and Tool Blue Book*, v. 54, Apr. 1959, p. 118 + 7 pages.

8187* Successive Grinding Cuts—Do They Affect Residual Stresses? Measurement of grinding stresses. Stresses from successive cuts are not cumulative, and they are not decreased by reducing down feed rate. Stresses depend mainly on wheel sharpness. ***L. M. Kubsh.*** *Machinery (New York)*, v. 65, no. 8, Apr. 1959, p. 116-119.

8188 Fabricating High-Strength Superalloys. This article, which is a slightly condensed version of a paper given before the American Society of Tool Engineers, discusses some of the problems affecting the fabrication of these alloys and the methods that have been developed to overcome them. ***H. E. Haley.*** *Metal Industry*, v. 94, Mar. 13, 1959, p. 203-206.

8189* Machinability of Steels and Cast Iron in Cutting-Off With Hard Alloy Cutting Tools. The influence of the material being cut-off on the cutting forces and the recommended feed and speed of cutting differs from the same influence during other types of metal machining with hard-alloy cutting tools. Cooling, new geometry of cutting tools, and correct operating conditions smoothes the difference between these influences and leads to an appreciable increase in cutting efficiency. (*In Russian.*) Obrabatyvaemost' staleĭ i chuguna pri otrezke tverdosplavnymi reztsami. ***G. L. Khaet.*** *Metallovedenie i Obrabotka Metallov*, 1959, no. 2, Feb., p. 49-53.

8190 Fabricating Sheet Metal for Aircraft. Aircraft and missile manufacture is sparking a revolution in sheet metal fabricating. Routine forming and joining methods formerly used are being replaced with techniques designed to handle the high-strength alloys needed for our supersonic aircraft. ***Adolph Vicek, Jr.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 77-79.

8191* Gray Cast Iron Machinability. Quantitative Measurements of Pearlite and Graphite Effects. Common types of unalloyed cupola-melted gray cast iron were studied to determine how changes in some of the major constituents of their microstructures affected machinability. The objective of the study was to make a contribution to the understanding of fundamental and basic factors affecting the machining ease of gray cast iron. ***W. W. Moore and J. O. Lord.*** *Modern Castings*, v. 35, Apr. 1959, p. 55-60.

8192 Over Estimates of Load for Some Two-Dimensional Forging Operations. The pressure to forge thick material with two dies of unequal width to cause the equal sideways displacement of material is derived using a slip-line field. The results are compared with those obtained using a discontinuous velocity field. Forging with two similar dies which cause unequal sideways material displacement is next examined. For thin material the forging pressure is determined using discontinuous velocity patterns for equal width perfectly rough dies. Similarly, instances in which the die widths are unequal, where flashes are formed and where the dies are perfectly smooth, are examined. Finally, forgings in which material flows in four, perpendicular directions are discussed. ***W. Johnson.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 571-579, (TA350 Un4p Over.)

8193 Chip Formation During the Turning Operation in the Presence of a Built-Up Nose. Chip formation in the turning operation, when some of the workpiece adheres to the base of the cutting tool forming a built-up nose, is analyzed as a plane strain problem of a perfectly plastic material. A slip-line field is presented which satisfies the stress and velocity boundary conditions of the problem. The results of this solution are then applied to provide expressions for the machining force and chip-thickness ratio. The solution for the turning operation is found to approach that for the orthogonal planing operation, as the radius of the workpiece is increased. ***Bernard W. Shaffer.*** Paper from "Proceedings of the Third U.S. National Congress of Applied Mechanics", The American Society of Mechanical Engineers, New York. 1958, p. 655-664. (TA350 Un4p Over.)

8194* New Design of Lathe Tools. Derives a factor called the "stability coefficient" based on the cutting feed at which tool failure occurs. Cutting tips held in the tool holder by cutting forces had the highest stability coefficient—i.e., permitted largest feed values for a given depth of cut and tool life. (*In Russian.*) Novaia konstruktsiia tokarnykh reztsov. **G. M. Ryvkin.** *Stanki i Instrument*, v. 30, no. 2, Feb. 1959, p. 29-30.

8195* Carbide Forging Dies. Carbide inserts for dies used to forge auto parts enabled one-stage forging operations and increased die life by a factor of 6 to 8 times. The dies are cut by electro-impulse machining and finished by a high-velocity jet of abrasives suspended in a liquid. (*In Russian.*) Tverdosplavnye kuznechnye shtampy. ***A. V. Pakhomov.*** *Stanki i Instrument*, v. 30, no. 2, 1959, p. 33-35.

8196 Steel Wire Products. These books are written for the different specialists of the steel wire industry. The first volume includes the following subjects: Processing and use of steel wire in producing strands, cables, welding electrodes, reinforced concrete, wire hardware, etc. The second volume comprises the processing and use of wire in cold-formed coil springs, balls, rollers, needles, pins, chains, nails, wire netting, barbed wire, etc. (*In German.*) *Stahldrahterzeugnisse.* v. I.-II. 340 and 315 pp. 1956. Verlag Stahleisen m.b.H., Düsseldorf, Germany. (TS270 V58s)

8197* Face Milling—Power Measurements Guide Tool Selections. Tests with a new torque dynamometer show that power consumption depends primarily on workpiece materials and tool sharpness. Relations between power consumption and chip thickness, chip width, width of cut, number of teeth, diameter of face mill, rake angle, cutting speed, and wear of tool were evaluated. ***Ivar Bendixen.*** *Tool Engineer*, v. 42, no. 4, Apr. 1959, p. 102-106.

8198* Controlling Grinding Stresses. Residual grinding stresses in a workpiece can be controlled within limits, both with respect to type and extent. Examples demonstrate effects of wheel type, downfeed, and coolant on stresses in hardened steel. Bath and quench also effectively reduce stresses. Critical effects of downfeed in grinding titanium are also discussed. ***A. L. Ball.*** *Tool Engineer*, v. 42, no. 4, Apr. 1959, p. 121-125.

8199* Why X-Rayed Diamond Tools? Many firms are promoting X-ray oriented diamond tools for maximum tool life. The use of X-ray diffraction techniques to determine the hardness direction of the diamond can mean a 500 to 1000% increase in diamond performance. ***Vern Palen.*** *Tooling & Production*, v. 25, no. 1, Apr. 1959, p. 56 + 1 page.

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

8200 Quenched-In Vacancies in Noble Metals. I. Theory of Decay. II. Mechanism of Quench Hardening. The decay of the quenched-in resistivity in Au observed by Bauerle and Koehler is analyzed on the basis of the present theory assuming a repulsive force between two vacancies separated from each other by a few atomic distances. For quenching from above a critical temperature, it is concluded that most of the vacancies disappear at the sessile rings as divacancies; for quenching from below the critical temperature, most of the vacancies disappear at stray dislocations in the network as single vacancies. A comparison of the observed quench hardening in Cu and Au with the decay of quenched-in resistivity in Au shows that the two types of hardening can be explained assuming two types of sinks for vacancies. For high quenching temperatures, the hardening is considered to be due to the formation of sessile rings; for low quenching temperatures, to the annihilation of vacancies at pre-existing dislocations. Detailed mechanisms for the annihilation of vacancies are discussed. ***H. Kimura, R. Maddin, and D. Kuhlmann-Wilsdorf.*** *Acta Metallurgica*, v. 7, Mar. 1959, p. 145-162.

8201 The Kinetics of Grain Boundary Grooving in Copper. Two predictions were tested by studying the grooving of tilt boundaries in copper annealed in dry hydrogen at 930 C and 1035 C. Both predictions agree with the experimental results. The validity of the theory allows one to calculate the surface diffusion coefficients, D_s. The advantages of this method of determining D_s are discussed. ***W. W. Mullins and G. P. Shewmon.*** *Acta Metallurgica*, v. 7, Mar. 1959, p. 163-170.

8202 The Dislocation Structure of Slip Bands in Iron. It was observed that the arrays when viewed normal to the edge component are straight but not coplanar over long distances, while the arrays where the screw component emerges from the surface show much curvature. In bend specimens, the increase in strain from the neutral plane toward the surface is accomplished mainly by the lateral growth of the first bands formed rather than by the formation of new slip bands. Observations made in the slip plane itself demonstrate that the motion of the screw components is considerably more limited than that of the edges. Evidence is presented for the existence of interaction between the edges and screw components of adjacent loops in agreement with the theoretical predictions. ***J. R. Low, Jr. and R. W. Guard.*** *Acta Metallurgica*, v. 7, Mar. 1959, p. 171-179.

8203 Electron Irradiation of Aluminum-Copper Alloys. Irradiation of quenched Al-2 at.% Cu alloys with 1.4 MeV electrons to integrated fluxes of 8×10^{18} electrons/cm^2 at −60 C showed that mobile irradiation defects can promote the low-temperature clustering of copper atoms at this temperature. Estimates assuming a vacancy-like irradiation defect indicate that it is reasonable to expect the formation of very small clusters with these irradiations. These results imply that the thermally activated low-temperature clustering of copper proceeds by an excess vacancy mechanism rather than a dislocation mechanism. ***C. W. Tucker, Jr. and M. B. Webb.*** *Acta Metallurgica*, v. 7, Mar. 1959, p. 187-190.

8204 Double Bragg Scattering in Cold-Worked Metals. The small-angle X-ray scattering from cold-worked metals is examined in terms of a double Bragg scattering mechanism. The intensity and angular distribution of the scattering expected from this mechanism are calculated and found to be in accord with experiment. It is shown that this mechanism should give a strongly polarized scattered flux at small angles and that the strong electric vector should be radial in the detecting plane. The polarization of the scattered flux was measured and found in agreement with these predictions. ***M. B. Webb and W. W. Beeman.*** *Acta Metallurgica*, v. 7, Mar. 1959, p. 203-209.

8205 The Nature of Mechanically Polished Metal Surfaces. Evidence is reviewed which establishes that the polishing of metal surfaces by mechanical metallographic methods occurs by cutting and not by surface flow. The new evidence, including that obtained by electron diffraction methods, indicates that there is, in fact, no Beilby Layer on such surfaces. ***L. E. Samuels.*** *Electroplating and Metal Finishing*, v. 12, Apr. 1959, p. 130-133.

8206* Structure and Solidification of Aluminum-Silicon Alloys. A study covering the composition of the alloy (Si = 11.7%; Fe = 0.051%; Cu = 0.06%; Na = 0.0005%, Ca = 0.008%). Three different cooling rates for a spherical Si container 0.75" in diameter, and the measurement of temperature. (*In Italian.*) Struttura e solidificazione delle leghe di alluminio silicio. *Fonderia*, v. 8, Feb. 1959, p. 76 + 1 page.

8207 Precipitation in Nickel-Base Alloys. In a recent paper, Manenc reports the results of a detailed investigation by X-ray methods of precipitation in a typical Nimonic of per cent composition chromium 19·5, aluminum 1·5, and titanium 2·4. The author considers that the evidence supports the theory of age-hardening as developed by Guinier for aluminum alloys. This is purely a academic point; what is important is that the investigation is a fine piece of systematic work by which it is established that hardening and strengthening are mainly associated with the strongly coherent stage of pre-precipitation. *Metal Industry*, v. 94, Mar. 13, 1959, p. 212.

8208 Titanium Alloys Today. Though the glamour is wearing off, titanium is definitely being established as a useful structural material. It is light, strong, and temperature resistant. Through alloy additions, either alpha or beta phase can be stabilized. Heat treatments, much like those used for steels, enhance the mechanical properties, particularly those of the alpha-beta and beta alloys. This review of alloying behavior and heat treatment should promote a better understanding of commercial alloys. Property data are provided in the Data Sheet. ***Paul D. Frost.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 95-98.

8209* Electrical Resistivity and Superstructure of $CuAu_3$. Superlattice formation was studied by measurements of electrical resistivity and by means of X-ray diffraction with a single crystal. After the alloy was quenched from 450 C, the isothermal change in resistivity was measured at various temperatures between 100 and 220 C. In most of the isothermal measurements, the resistivity increased with the time of annealing, possessing an activation energy of 25 ± 2 Kcal/mol. It was found, however, that after prolonged annealing at 162 and 175 C, a slight decrease in resistivity took place following an initial increase. The transition point of this alloy was determined as 200 ± 5 C. ***Makoto Hirabayashi.*** *Physical Society of Japan, Journal*, v. 14, Mar. 1959, p. 262-273.

8210* On the Growth Conditions of Germanium. Effect of growth conditions of pulled, single-crystal Ge on structural and physical properties. N-type single crystals containing a very small amount of As, are pulled in the (111) direction, and four kinds of crystals with different growth conditions are illustrated. ***Takeo Sasaki.*** *Physical Society of Japan, Journal*, v. 14, Mar. 1959, p. 381-382.

8211 Fourier Methods in Structure Analysis by Electron Diffraction. Methods are reviewed and a rational and uniform nomenclature is proposed. Application of Fourier methods to the analysis is outlined and illustrated for polycrystalline and single-crystal specimens. ***J. M. Cowley and A. L. G. Rees.*** Paper from "Reports on Progress in Physics", v. XXI, p. 165-225. 1958. The Physical Society, London. (QC3 P56r Vis.)

8212* Influence of Quenching Rate on the Structure of the Ti-Al 6% - V 4% Alloy, Quenched and Quenched and Tempered. The investigation was made principally by the use of the electron microscope. After rapid quenching from 850 C, the product has a wide range between elastic limit and tensile strength as well as a high degree of susceptibility to tempering, the β decomposition being martensitic in type. When quenching is retarded or if one proceeds to a tempering treatment, the β transformation takes place by nucleation and growth. The elastic limit increases. (*In French.*) Influence de la vitesse de trempe sur la structure de l'alliage Ti-Al 6% - V 4 % trempé et trempé-revenu. ***A. Saulnier.*** *Revue de Métallurgie*, v. 56, Mar. 1959, p. 205-214.

8213* The Effect of Additions of Cu, Zn, and Ag on the Recrystallization of Super-Purity Aluminum. (*In French.*) Influence d'additions de Cu, Zn et Ag sur la recristallisation d'aluminium de très haute pureté. ***J. C. Blade.*** *Revue de Métallurgie*, v. 56, Mar. 1959, p. 229-236.

8214* Some Aspects of Precipitation in a Nickel-Titanium Alloy. The nickel-base alloy which was studied contained 9.26% titanium. This composition allows of hardening by precipitation after solution treatment, quenching and reheating. When the equilibrium phase is the definite hexagonal compound Ni_3Ti, precipitation takes place in three stages. A stage of pre-precipitation with abnormal diffusion in the form of knots and secondary rays in the X-ray diagrams. A stage when one finds a precipitate with face-centered cubic structure, slightly tetragonal, since the cube faces follow the matrix in epitaxis according to the (100) planes. The final stage corresponds to the appearance of the stable hexagonal precipitate, partly inside the grains in the form of coherent plates following the (111) planes, and partly at the grain boundaries by discontinuous precipitation and recrystallization. (*In French.*) Quelques aspects de la précipitation dans un alliage nickel-titane. ***C. Bückle, B. Genty, and J. Manenc.*** *Revue de Métallurgie*, v. 56, Mar. 1959, p. 247-259.

8215* The Recrystallization of "Zone-Melted" Aluminum. Electrolytic polishing and anodic oxidation of Al at −60 C. Micrographs of "zone-melted" Al were obtained during the course of recrystallization at −52, −48, and −38 C. (*In French.*) Sur la recristallisation de l'aluminium de zone fondue.

O. Dimitrov and Ph. Albert. *Revue de Métallurgie*, v. 56, Mar. 1959, p. 267-271 + 3 plates.

8216* Cine-Micrographic Investigation of the Allotropic Transformation of Cobalt and the Cobalt-Nickel Alloys. The allotropic transformation of cobalt (hexagonal ⇌ face-centered cubic) was studied by means of the hot stage microscope equipped with a camera. Appearance of martensitic platelets, effect of stress at the grain boundaries (caused by anisotropic expansion), and propagation of the point of transformation were studied using 6,000 exposures per sec. (*In French.*) Étude cinémicrographique de la transformation allotropique du cobalt et des alliages cobalt-nickel. ***Herré Bibring, Gabriel Lenoir, and François Sebilleau.*** *Revue de Métallurgie*, v. 56, Mar. 1959, p. 279-287.

8217* Self-Diffusion in Solid Lithium. (*In Russian.*) Samodiffuziia v tverdom litii. ***A. N. Naumov and G. Ia. Ryskin.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 29, no. 2, Feb. 1959, p. 189-191.

See also: **7723** (structure of Fe and Cr electrodeposits); **8191** (microstructure of cast iron).

METALS—POWDER

8218 Pressureless Sintered Beryllium. I. Production Techniques. II. Evaluation of a New Process. ***T. R. Barrett.*** *Engineering*, v. 187, Mar. 27, 1959, p. 412-414; Apr. 3, 1959, p. 437-439.

8219* The Use of Super-Hard Alloys for High-Pressure Containers. A summary is presented of literature data on the required mechanical and physical properties of super-hard alloys for high-pressure containers. Graphs are plotted which show the influence of temperature and of the content of alloying elements on mechanical constants of various hard alloys. (*In Russian.*) Primenenie sverkhtverdykh splavov v sosudakh vysokogo davleniia. ***Iu. N. Riabinin.*** *Fizika Metallov i Metallovedenie*, v. 6, no. 5,. 1958, p. 893-899.

8220 Process Compacts Metal Powders Into Continuous Bars. A simple compacting process transforms metal and ceramic powders into sheet, strip, or bar. Continuous, it produces bars or strips of large cross-section with excellent surfaces and edges. ***F. Emley and C. Deibel.*** *Iron Age*, v. 183, no. 17, Apr. 23, 1959, p. 112-113.

8221* Sizing and Coining of Metal-Powder Parts. ***John Haller.*** *Machinery (New York)*, v. 65, no. 8, Apr. 1959, p. 135-138.

8222 Designing for Metal Powder Structural Parts. Properties, design, finishing, uses, and economics of the use of metal powder parts. ***John L. Everhart.*** *Materials in Design Engineering*, v. 49, Apr. 1959, p. 113-124.

8223 Heat Treatment of Sintered Iron. Effects of carburizing and other treatments on density and hardness. ***Ivan Ljungberg and P. Ulf Gummeson.*** *Precision Metal Molding*, v. 17, Apr. 1959, p. 30 + 2 pages.

8224 A Wide Variety of Metal Powders Is Available to Let You Design With Non-Ferrous Sinterings. In spite of the limitations imposed by rigid tooling and by the variety of motions that can be built into either presses or tools, powder metallurgy is one of the most flexible fabricating methods available to the design engineer. This flexibility comes from the infinite variety of metal alloys and mixtures that can be used to fabricate parts and from the wide latitude in processing to give special or different physical and/or mechanical properties to the sinterings. *Precision Metal Molding*, v. 17, Apr. 1959, p. 32-33.

8225 MPI Reports More Sinterings in '59 Cars. There is a significant increase in the use of powder metallurgy parts for structural components by the automotive industry. This trend has been developing over the past ten years. *Precision Metal Molding*, v. 17, Apr. 1959, p. 34 + 2 pages.

See also: **7651** (sulfidizing sintered Fe); **7718** (electrolytic Cu powder); **8154** (nitrided pressing dies).

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

8226* Some Factors Influencing the Production and Control of Quality of Aluminium-Alloy Die-Castings. Significant factors which influence the production and the quality of die-castings of both gravity and pressure types in aluminum-base casting alloys are described. Briefly reviews the more important aspects of the control of quality of castings. ***R. R. Woodward and H. J. Proffitt.*** *British Foundryman*, v. 52, Mar. 1959, p. 119-126.

8227 Flaw Detection by a Coloring Technique. Improvements to coloring technique for detection of defects on magnetic and nonmagnetic materials are described. Procedure, composition of dye solution; timing of the two inspections and conclusions from visual observations. ***N. V. Khimenko.*** *Henry Brutcher Translation No.* 4418, 6 pp. (From *Zavodskaya Laboratoriya*, v. 23, no. 7, 1957, p. 803-806.) Henry Brutcher, Altadena, Calif.

8228 Improved Method of Flaw Detection by Coloring. Development work on new solutions evaluated by color intensity, wetting power, penetrating power, freezing point, and ease of removal from surfaces inspected. ***S. I. Kalashnikov and N. P. Kichin.*** *Henry Brutcher Translation No.* 4419, 5 pp. (From *Zavodskaya Laboratoriya*, v. 23, 1957, p. 806-808.) Henry Brutcher, Altadena, Calif.

8229 Maximum Inspection Efficiency by Linear Programming. The thought behind linear programming's application to quality examinations is that piecemeal analysis of individual quality problems does not always result in a best solution as when considering operations as a whole; and that a significant increase in quality information and yields could be accomplished with this type of thinking. ***Gerald H. Sandler.*** Paper from "Fifth National Symposium on Reliability & Quality Control in Electronics, Proceedings", The Institute of Radio Engineers, New York. 1959, p. 217-223. (TK7801 N21p Over.)

8230 Electronic "Longhand" Aids Quality Control. An in-plant telescriber system. *Industrial Laboratories*, v. 10, Apr. 1959, p. 6.

8231 X-Rays Play Key Role in American Smelting Research. Diffraction, spectrographic, and microradiographic techniques solve in-plant and customer problems over a wide area. ***Vern W. Palen.*** *Industrial Laboratories*, v. 10, Apr. 1959, p. 54 + 3 pages.

8232 X-Rays Inspect Welding Seams. Economies of X-ray inspection technique in manufacture of pressure tanks. *Industrial Photography*, v. 8, Apr. 1959, p. 24 + 1 page.

8233 How Quality Control Leads to Better Product Design. Saw chain quality must be matched with product design changes. ***H. P. Blood.*** *Iron Age*, v. 183, no. 16, Apr. 16, 1959, p. 115-117.

8234* Production-, Quality- and Permeability Control of Plastic Pipes. The purpose of quality control is to ensure that a pipe made with rigid PVC, normal or rigid polyethylene will have a useful life of 50 years. Elevated temperatures are used in order to notice any peculiarities which would influence long-term behavior, at an early stage. (*In German.*) Qualitätskontrolle, Fertigungskontrolle und Dichtheitsprüfung von Kunststoffrohren. ***Erwin Nümann and Otto Umminger.*** *Kunststoffe*, v. 49, Mar. 1959, p. 113-116.

8235 Ultrasonic Testing at Douglas. Internal soundness and good bonds are essential in forgings and honeycomb panels for today's aircraft. Improvements in ultrasonic testing methods help to maintain quality at all times. A "cylindricator" helps to determine flaw location. Its operation is described in detail. ***W. C. Hitt.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 80-85.

8236* Experiences Made With a 15-MeV Betatron in the Nondestructive Testing of Steel Products. Delimitation of the possibilities for using the X-ray radiography, radioactive isotopes

and betatron apparatus. Practice of taking images with the betatron. Effect of amplifying foils. Relation between blacking of the film, field compensation, duration of exposure, and perceptibility of defects. Possibilities of appreciating the films. Perceptibility of a wire used as test body and duration of exposure with different types of films. Wire perceptibility under different conditions of exposure, in particular with magnifications. Design and industrial use of the 15-MeV betatron. Measures taken for protection against radiation and disposition of the equipment. Location of the defects according to the stereoscopic method. Examples of application. (*In German.*) Erfahrungen mit einem 15-MeV-Betatron bei der zerstörungsfreien Prüfung von Stahlerzeugnissen. ***Hans Krächter.*** *Stahl und Eisen*, v. 79, no. 7, Apr. 2, 1959, p. 419-426.

8237 The Immersed Ultrasonic Inspection of Metal Plate. Techniques for the ultrasonic inspection of metal plate in thicknesses down to ¼ in. Many sources of difficulty and their obviations are cited. ***R. W. McClung.*** *U. S. Atomic Energy Commission, ORNL-2650*, Apr. 6, 1959, 23 pp. (UF767 U3o Contin.)

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

8238* On the Magnitude of Strange Particle Production Cross-Section in Nucleon-Nucleon Collisions at Cosmotron Energy. The probabilities of production of different kinds of particles and their momentum distribution for (NN)—collision et E = 3 BeV are calculated by the method of statistical theory. ***V. S. Barashenkov and V. M. Maltsev.*** *Acta Physica Polonica*, v. 17, no. 6, 1958, p. 397-400.

8239* On the Bilocal Theory of the Electron. ***E. Minardi.*** *Acta Physica Polonica*, v. 17, no. 6, 1958, p. 429-433.

8240* Perturbation Theory in Nuclear Reactions. Shows that, with a particular weight function, the scattering amplitude can be averaged over energy by going to a complex energy. The average amplitude is then expressed in terms of a perturbation expansion. ***G. E. Brown, C. T. De Dominicis, and J. S. Langer.*** *Annals of Physics*, v. 6, Mar. 1959, p. 209-229.

8241* The Radiochemical Study of Pion Production Nuclear Reactions. Study of reactions of the type (p. $\pi \pm$) and p, pπ +) on nuclei of elements with a medium atomic weight. (*In Russian.*) Radiokhimicheskoe izuchenie iadernykh reaktsiĭ, privodiashchikh k obrazovaniiu π - mezonov. *Atomnaia Energiia*, v. 6, no. 2, Feb. 1959, p. 145-151.

8242* Neutron Scattering in Para and Orthohydrogen. Establishment of the dependence of the full cross-section, average scattering, asymmetry and average energy loss at one collision in para- and orthohydrogen upon neutron energy and temperature of the surrounding medium. The results are presented in the form of formulas and graphs. Investigation of the energy field at a temperature when the thermal motion of molecules can be neglected. Calculation of the excitation of rotary levels and zero vibrations of nuclei in the molecule. ***E. A. Chistova and S. I. Drozdov.*** *Atomnaia Energiia*, v. 6, no. 2, Feb. 1959, p. 152-161.

8243* The Electrostatic Accelerators of Charged Particles. Review of studies of accelerators with an emphasis on the problems of increasing the energy of accelerated particles and the power of the beam in electrostatic generators. Comparison of various voltage stabilizing methods. Investigation of cascade generators for obtaining high-power beams. (*In Russian.*) Elektrostaticheskie uskoriteli zariazhennykh chastits. ***V. N. Glazanov.*** *Atomnaia Energiia*, v. 6, no. 2, Feb. 1959, p. 174-186.

8244* Heat Separating Elements of Nuclear Reactors. The paper describes the design of heat-separating elements and provides data on these elements for a number of reactors. The information is based on foreign reports submitted to the Second International Conference on the Use of Atomic Energy for Peaceful Purposes (Geneva, 1958). It considers problems on the selection of fuel, structural materials, and production technology of the heat separating elements for nuclear reactors of various types. (*In Russian.*) Teplovydeliayushchie elementy iadernykh reaktorov. ***A. G. Samoilov and V. S. Volkov.*** *Atomnaia Energiia*, v. 6, no. 3, Mar. 1959, p. 261-276.

8245* The Excitation Energies of Fission Fragments. It is shown that the excitation energy of fragments can be determined by solving a system of equations of the deformation parameters of fragments and distance between them. Initial conditions for this system of equations are established and the excitation energy of fragments of some nuclei is established. The dependence of the excitation energy upon the atomic number and atomic weight of the fissionable nucleus is investigated. (*In Russian.*) Ob energii vozbuzhdeniia oskolkov pri delenii iader. ***B. T. Geilikman.*** *Atomnaia Energiia*, v. 6, no. 3, Mar. 1959, p. 298-305.

8246* Tritium Production and Cycling in a Fusion Reactor With Lithium Blanket. The principle of a fusion reactor is that deuterium nuclei are made to fuse with one another and with tritium nuclei, to form helium nuclei, and thus produce energy. Concerns the tritium cycle and shows how the slowing down, spatial distribution, and absorption of the neutrons by the lithium can be calculated by two different approximate methods. Since lithium has a low scattering cross-section, it is unsuitable for slowing down the neutrons, but this can be circumvented. ***K. Hintermann and R. Wideröe.*** *Brown Boveri Review*, v. 45, nos. 11/12, Nov./Dec. 1958, p. 588-595.

8247* Radioactive Decay of Au^{200}. Half-life, β- and γ-radiations, and decay scheme are reported. ***J. C. Roy and L. P. Roy.*** *Canadian Journal of Physics*, v. 37, Apr. 1959, p. 385-395.

8248* Measurement of the Energies of Nuclear States Excited by Inelastic Neutron Scattering, and a Search for Electric Monopole Transitions in Pb. ***J. E. Evans, B. B. Kinsey, and B. G. Whitmore.*** *Canadian Journal of Physics*, v. 37, Apr. 1959, p. 396-412.

8249* Absolute β-Counting in a Proportional Flow-Counter. Self-absorption and backscattering of β-particles were studied and empirical formulae obtained to correct for these factors in absolute β-counting. ***J. P. Roalsvig and R. N. H. Haslam.*** *Canadian Journal of Physics*, v. 37, Apr. 1959, p. 499-514.

8250 Dresden Nuclear Power Station. Safety systems which fortify other systems to provide reliable safeguards against infraction of normal operating procedures. ***W. J. Shewski.*** *Electrical Engineering*, v. 78, Apr. 1959, p. 304-309.

8251 Operating Experience With the Vallecitos Boiling Water Reactor. Besides being power-producing, the VBWR's fundamental purpose is to provide a facility for testing fuel and operating components for other reactor plants. ***L. Kornblith, Jr. and W. A. Raymond.*** *Electrical Engineering*, v. 78, Apr. 1959, p. 334-338.

8252* Engineering Developments in Nuclear Power. Includes the development of the fuel element, the pressure vessel, and circulatory system. *Engineer*, v. 207, Apr. 3, 1959, p. 528-532.

8253 Fast Flux. Without breeding, known deposits of U can only meet a substantial part of world energy requirements for a few decades and, for U, breeding can only be accomplished in a reactor operating on fast neutrons. *Engineering*, v. 187, Mar. 13, 1959, p. 334-336.

8254 Glove Boxes and Shielded Cells for Handling Radioactive Materials. Text material is based on a record of the Proceedings of the Symposium on Glove Box Design and Operation held in the Cockcroft Hall, A.E.R.E., Harwell, on February 19-21, 1957, consisting of some 50 papers. ***G. N. Walton, et al., editors.*** 515 pp. 1958. Butterworths, London. (TK9400 Sy68g.)

8255 Industrial Power From Atomic Nuclei. Introduction to the physics and engineering of the atomic reactor and atomic power plant. (*In German.*) Nutzenergie aus Atomkernen. ***Karl Rudolf Schmidt.*** v. I. 594 pp. 1959. Walter de Gruyter & Co., Berlin. (TK9145 Sch54n)

8256* Internal Conversion Coefficients. Tabular data. ***M. E. Rose.*** 173 pp. 1958. Interscience Publishers, New York. (QC783 R72i Ref.)

8257* Invariant Imbedding and Neutron Transport Theory III—Neutron-Neutron Collision Processes. Neutron-neutron collisions are now considered with scattering, absorption, and fission processes. ***Richard Bellman, Robert Kalaba, and G. Milton Wing.*** *Journal of Mathematics and Mechanics*, v. 8, no. 2, Mar. 1959, p. 249-262.

8258 Nuclear Explosions in Space. Many techniques exist for detecting trapped particles. Adequate inspection procedures may be difficult to establish. ***S. Fred Singer.*** *Missiles and Rockets*, v. 5, no. 16, Apr. 20, 1959, p. 26 + 3 pages.

8259* Atomic Beam Research on Radioactive Atoms. Information on nuclear static moments and the electronic states of the heavy elements. ***W. A. Nierenberg.*** *National Academy of Sciences, Proceedings*, v. 45, Apr. 1959, p. 429-450.

8260* Symposium on the Lawrence Radiation Laboratory. Consists of the following papers: "The Bevatron", "Forces Between Nucleons and Antinucleons", "Nuclear Spectroscopy", and "Recent Work With the Transuranium Elements". ***Edward J. Lofgren, Geoffrey F. Chew, I. Perlman, and Glenn T. Seaborg.*** *National Academy of Sciences, Proceedings*, v. 45, Apr. 1959, p. 451-482.

8261 Measurements and Standards of Radioactivity. Covers α, β, and γ measurements and standards. Includes data on electron capture nuclides, low energy emitters, and low level counting. *National Research Council, Committee on Nuclear Science, Nuclear Science Series Report No.* 24, 1958, 155 pp. (QC771 N21nr Contin.)

8262* High Energy Particle Accelerators. After defining "high energy", the author describes the basic features of linear and circular accelerators, of a cyclotron, betatron, synchrotron. A new principle concerning the stabilization of particle paths as well as new designs are considered. (*In German.*) Hochenergie-Teilchenbeschleuniger. ***Helmut Steinwedel.*** *Naturwissenschaften*, v. 46, no. 5, Mar. 1959, p. 163-167.

8263* How We Developed the *Nautilus* Machinery. Problems met in the design and testing of the Nautilus prototype machinery. ***E. E. Kintner.*** *New Scientist*, v. 5, Mar. 26, 1959, p. 694-698.

8264 A Periodic Table for Fundamental Particles. The existence of unique relations among the fundamental particles based on exponentials of $\frac{\pi}{4}$ has been discovered in the search for symmetry, unity, and simple structure. Avoids any explanation of the fundamental why and how by merely stating the analysis of the data and one possible sequence of geometric configurations based upon it. ***John J. Grebe.*** *New York Academy of Sciences, Annals*, v. 76, art. 1, Sept. 15, 1958, 15 pp. (Q11 N49a Contin.)

8265* The 7 GeV Proton Synchrotron. Theoretical Aspects. Engineering Design. Buildings, Civil Engineering and Service. *T. G. Pickavance, P. Bowles, G. W. Dixon, and A. G. Entwistle.* *Nuclear Engineering*, v. 4, Apr. 1959, p. 151-169.

8266* Reactor Physics for the Electrical Engineer. I. A new approach is made to one-group reactor physics. The concept of "buckling" is abandoned in favor of expressions more familiar to the electrical engineer. ***J. C. James.*** *Nuclear Engineering*, v. 4, Apr. 1959, p. 170-174.

8267* Fuel Elements Today and Tomorrow—Some Current Developments. Expected course in metallic fuels for the immediate future, UO_2 in metallic cans in 5 to 10 years, and in the more distant future, graphite cladding. ***G. B. Greenough.*** *Nuclear Power*, v. 4, Apr. 1959, p. 92-96.

8268* Dragon—Details of the 10 MW HTGR. *Nuclear Power*, v. 4, Apr. 1959, p. 102-103.

8269* Dust Removal in Gas-Cooled Reactors. Concerns high efficiency filtration in CO_2 circuits. Considers use of miniature cyclone tubes. ***R. A. LePage.*** *Nuclear Power*, v. 4, Apr. 1959, p. 104-107.

8270 Nuclear Propulsion and Engineering for Engineers. Discusses the fundamentals of nuclear physics from the point of view of aircraft propulsion. Covers reactor theory and design including both conventional and unconventional reactor types; unsteady operation, matching, control and instrumentation of reactors; and materials for reactor components such as fuels, moderators, reflectors, and shielding. It also discusses thermal, mechanical, and radiation stressing as well as failures. The book outlines the utilization of nuclear energy both in thermal and in non-thermal form, and gives a complete analysis and discussion of air cooled and liquid cooled reactors for turbojets with design data as well as sea level and altitude performance analysis. ***D. G. Samaras.*** 731 pp. + 73 tables + 220 figures. The Technical Chamber, Athens, Greece.

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8274* Calculated Activities and Abundances of U^{235} Fission Products. Computed disintegration rates and numbers of atoms of each fission product radionuclide at various times after simultaneous slow neutron fission of 10,000 atoms of U^{235} are presented. Based on fission yields from two different theories of independent fission yields. Data are graphed. ***R. C. Bolles and N. E. Ballou.*** *Nuclear Science and Engineering*, v. 5, Mar. 1959, p. 156-185.

8275* Restricted Minimum Critical Mass. Restricted distributions varying by steps are investigated in the particular case of "spherical" symmetry. ***J. Devooght.*** *Nuclear Science and Engineering*, v. 5, Mar. 1959, p. 190-194.

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8279* A Systematic Study of Hyperfragments Produced by 4.5 GeV π^- in Nuclear Emulsion. I. π^--Mesic Decays. II. Non-Mesic Decays. I. ***W. E. Slater.*** II. ***E. M. Silverstein.*** *Nuovo Cimento*, v. 10, ser. 10; Supplemento No. 1, 1958, p. 1-67 + 8 plates.

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8281* Applications of Ionizing Radiation. Potential application of radiation in the fields of rubber vulcanization, polymerization, halogenation, food sterilization, and insect control are reviewed. ***Bernard Manowitz.*** *Official Digest*, v. 31, Apr. 1959, p. 560-574 .

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8286 Inelastic Scattering of Protons by Various Nuclei. Experimental data on the inelastic scattering of 23-Mev protons reported earlier are analyzed by using the theory of direct interaction together with the plane wave approximation. ***T. Tamura and D. C. Choudhury.*** *Physical Review*, v. 113, 2nd ser., no. 2, Jan. 15, 1959, p. 552-562.

8287 Structure of the Neutron. Earlier the contribution of the meson current to the electromagnetic structure of the nucleon was calculated by use of the dispersion relations for pion-nucleon scattering. Here the contribution of the nucleon current to the electromagnetic structure of the neutron is obtained analogously by use of the dispersion relations for neutron-proton scattering. ***Katsumi Tanaka.*** *Physical Review*, v. 113, 2nd ser., no. 2, Jan. 15, 1959, p. 714-725.

8288* Gamma Rays From the Proton Bombardment of ^{24}Mg, ^{25}Mg and ^{26}Mg. The gamma-rays following the inelastic scattering of protons by ^{24}Mg, ^{25}Mg and ^{26}Mg were investigated at proton energies up to 5.7 MeV. The energy spectra of the gamma-rays at several proton energies have been obtained for each isotope: 2^+ was assigned to the second, third, and fourth excited level of ^{26}Mg considering the gamma-ray branching ratios for those levels. ***Iwao Miura, Tetsuo Wakatsuki, Yasuo Hirao, and Eiji Okada.*** *Physical Society of Japan, Journal*, v. 14, Mar. 1959, p. 239-247.

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8290* The Vapor Container for the Yankee Atomic Electric Plant. The containment vessel is supported above ground on pipe columns. At the same time, the internal concrete structure is supported on concrete columns. ***Charles T. Chave and O. P. Balestracci.*** *Power Engineering*, v. 63, Apr. 1959, p. 52-54.

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8292* Progress in the Development of Fuel Elements. Reviews developments of the last 15 years beginning with the proposed use of "Tuballoy", which soon proved inadequate because of coolant contamination. Electroplated coatings were then tried, followed by Al cladding, Al-Ni alloys, Be sheet, stainless steels, and Hf-free Zr and the Zircaloys. Modification of the fuel is also developed. ***Howard W. Russell.*** Paper from "Power Reactor Conference. Proceedings of a Meeting Held November 26, 27, 28, 1956 at Fabrimétal, Brussels, Belgium", p. 162-165, 1956. Atomic Industrial Forum, New York. (TK9202 P87 Over.)

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8301 Nuclear Alinement of Manganese-56. Shows the feasibility of alining manganese-56 produced by neutron irradiation of a nickel fluosilicate crystal containing stable ^{55}Mn. Measurements were made of the angular distribution of the γ-radiation from the alined ^{56}Mn and also of the angular correlation of the γ-rays from this isotope. ***P. Dagley, M. A. Grace, J. M. Gregory, and J. S. Hill.*** *Royal Society, Proceedings*, v. 250, ser. A, Apr. 7, 1959, p. 550-561.

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8307 Liquid Metal Fuel Reactor Experiment. Reference Design Report. *U. S. Atomic Energy Commission, BAW-1019*, Aug. 1957, 266 pp. (UF767 Un3.1ba Contin.)

8308 Postirradiation Examination and Evaluation of an OMRE Fuel Assembly. A fuel-element assembly from the first loading of the OMRE was examined in detail after experiencing an average uranium burnup of between 1 and 2 a/o. The rate of decay heat generation was evaluated by temperature monitoring of the shipping-cask coolant. Temperatures of the fuel-element-box assembly and the fuel plates were measured with thermocouples and Tempilstiks. Structurally, the fuel-element assembly was affected very little by either radiation or the organic coolant-moderator. ***Richard J. Burian and John E. Gates.*** *U. S. Atomic Energy Commission, BMI-1319*, Feb. 11, 1959, 62 pp. (UF767 U3b Contin.)

8309 Alumina-Clad UO_2 for Fuel Applications. Using a special reactive form of high-purity alumina, claddings were applied to UO_2 particles by a tumbling technique. The clad pellets were isostatically pressed at 100,000 psi and then sintered at 2800 F in hydrogen. Crack-free spheroidal pellets ranging from 1000 to 2000 μ in diameter were produced. The dense Al_2O_3 envelopes surrounding the UO_2 particles were estimated to be 300 to 500 μ thick. ***Allison K. Smalley, William C. Riley, and Winston H. Duckworth.*** *U. S. Atomic Energy Commission, BMI-1321*, Feb. 18, 1959, 6 pp. (UF767 U3b Contin.)

8310 Thorium Suspension in Liquid Metals. Suspensions of thorium in liquid metals are being considered for use as fluid breeder blanket materials in thermal reactors with a U^{233}-Th^{232} fuel cycle. Such suspensions would be expected to possess most of the advantages of fluid materials for reactor use. ***Joseph S. Bryner.*** *U. S. Atomic Energy Commission, BNL-483* (C26), Jan. 9-10, 1958, p. 138-142. (UF767 Un3.1bn Contin.)

8311 Experiments in Low Decontamination Processing of Metallic Thorium-Uranium Fuels. ***G. E. Brand, E. W. Murbach, and A. G. Buyers.*** *U. S. Atomic Energy Commission, BNL-483* (C26), Jan. 9-10, 1958, p. 157-163. (UF767 Un3.1bn Contin.)

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8317 Reactor Technology Report No. 8—Metallurgy. Covers developments in fuels, controls, structural materials, and process metallurgy. *U. S. Atomic Energy Commission, KAPL-2000-5*, Mar. 1959, 204 pp. (UF767 Un3.1ka Contin.)

8318 Reference Design for an OMR-Powered 38,000-DWT Tanker. Shows that the OMR concept is a promising approach to supertanker operation because of exceptional safety characteristics, ease of operation, and economic potential. ***R. J. Gimera and R. E. Stanbridge.*** *U. S. Atomic Energy Commission, NAA-SR-1851* and Suppl. Mar. 18, 1957, 141 pp. (UF767 Un3.1na Contin.)

8319 Lead-Lithium Shielding Alloy—Metallurgical Studies. Alloying and casting studies conducted on a Pb-0.69 wt.% Li alloy, a proposed shielding material, are presented. The Pb-Li alloy is attacked by water with an accompanying volume increase and cracking. Corrosion was much more severe in boiling water than in room-temperature water. The Pb-Li alloy has good rolling characteristics. No cracks or surface defects were observed on a piece which was rolled to 92.5% reduction. ***D. H. Jansen, E. E. Hoffman, and D. M. Shepherd.*** *U. S. Atomic Energy Commission, ORNL-2404*, Mar. 23, 1959, 20 pp. (UF767 U3o Contin.)

8320 Development of Silicon-Modified 48 Wt % U-Al Alloys for Aluminum Plate-Type Fuel Elements. The 20% limitation on U-235 enrichment of uranium exported under the Atoms-for-Peace Program has created the need for development of 35 to 50 wt% U-Al alloys. These alloys, when modified with ternary additions of 3 wt% Si, Zr, Ge, Ti, or Sn, contain essentially no UAl_4, but instead, retain UAl_3 as the stable compound. This structural modification, which reduces the volume percentage of intermetallic compound, improves the quality of the fuel alloy in comparison with an unmodified alloy of the same uranium content. The present work discusses casting procedures, mechanical working characteristics, composite fuel plate fabrication, and fuel element assembly methods for a nominal 48 wt% U - 3 wt% Si-Al alloy. ***W. C. Thurber and R. J. Beaver.*** *U. S. Atomic Energy Commission, ORNL-2602*, Mar. 23, 1959, 49 pp. (UF767 U3o Contin.)

8321 Resonance Absorption of Neutrons in Nuclear Reactors. Formulae for the effective resonance integral of single resonances are given in the "narrow resonance" approximation in homogeneous media, and in the "narrow resonance" and "infinite mass absorber" approximation in heterogeneous media. ***Lawrence Dresner.*** *U. S. Atomic Energy Commission, ORNL-2659*, Mar. 10, 1959, 232 pp. (UF767 U3o Contin.)

8322 Theory of Small Oscillations in Boiling Water Nuclear Reactors. Models proposed by several authors to describe small oscillations of the power of a reactor are shown to lead to a feedback equation between definite limits. ***H. C. Corben, D. B. Langmuir, and R. S. Margulies.*** *U. S. Atomic Energy Commission, RWC 22-122*, June 1958, 33 pp. (UF767 Un3.1rw Contin.)

8323 Power Bursts in Nuclear Reactors. Shows that some of the properties of a power burst in a reactor are independent of either the feedback mechanism or the pile kinetics, and may be described quantitatively with no assumption other than that the pile kinetic equations are nonlinear. ***H. C. Corben.*** *U. S. Atomic Energy Commission, RWC-22-127*, Sept. 4, 1958, 21 pp. (UF767 Un3.1rw Contin.)

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8325 Thermoelectric Nuclear Fuel Elements. First Quarterly Progress Report. Preliminary thermoelectric element design considerations have been formulated to provide guidance in the selection of materials, shapes, dimensions, and fabrication procedures. ***F. L. Carter, et al.*** *U. S. Atomic Energy Commission, WCAP-1030*, Nov. 15, 1958, 67 pp. (UF767 Un3.1wc Contin.)

8326* Decay Properties of Heavy Mesons and Hyperons. Review of recent studies in this field providing 293 references. (*In Russian.*) Raspadnye svoĭstva tiazhelykh mezonov i gipero-

nov. ***E. O. Okonov.*** *Uspekhi Fizicheskikh Nauk*, v. 67, no. 2, Feb. 1959, p. 245-291.

8327* Nuclear Power for the Propulsion of Commercial Shipping. Although the technical feasibility and reliability of nuclear propulsion can now be taken for granted, the economic feasibility of commercial nuclear propulsion is far less certain at the present time. If the capital cost of a nuclear ship were 1 million pounds more than for a conventional ship, leading to an additional capital charge of 150,000 pounds per annum, nuclear fuel costs would have to be as low as 50,000 pounds per annum, or a quarter of conventional fuel costs, if the nuclear ship were to break even. Lower cost government financing would alter the picture. Capital costs per shaft horsepower fall more rapidly with increasing power for nuclear units than for conventional units. Nuclear propulsion will therefore have a greater chance of being competitive for high-power units than for small units. ***John Cockcroft.*** *Welder*, v. 27, no. 136, Oct.-Dec. 1958, p. 74-81.

8328* On the Three- and Four-Body Problem of Nuclear Physics. The independent pair model has been applied and the equations of the model have been solved by a perturbation approach in the case of spin- and charge-independent central two-body forces with hard-core. (*In German.*) Zum Drei- und Vierkörperproblem der Kernphysik. ***H. J. Mang and W. Wild.*** *Zeitschrift für Physik*, v. 154, no. 2, 1959, p. 182-217.

8329* The Electron, Positron, and Gamma Spectrum of ^{64}Cu. Results of an investigation of the β^- and β^+ and of the gamma radiation of ^{64}Cu. (*In German.*) Das Elektronen-, Positronen- und Gammaspektrum des ^{64}Cu. ***Wolf-Dieter Schmidt-Ott.*** *Zeitschrift für Physik*, v. 154, no. 3, 1959, p. 286-293.

8330* Measurement and Analysis of the Angular Distribution and Cross Section of the Effect of the Reaction $F^{19}(p, \alpha_0)O^{16}$ in the Range of Energy Between 0.4 and 0.72 MeV. Total and differential cross section from $F^{19}(p, \alpha_0)O^{16}$ has been studied at effective proton energies 0.485; 0.55; 0.60; 0.64; 0.676; 0.72 MeV. In this range of energy, the angular distribution shows a pronounced energy dependence. An analysis of the results has made it possible to determine the state of the known resonance at 0.72 MeV. Moreover, the existence of some weak broad resonances below 0.7 MeV could be gathered from the angular distribution. (*In German.*) Messung und Analyse von Winkelverteilung und Wirkungsquerschnitt der Reaktion $F^{19}(p,\alpha_0)O^{16}$ im Energiebereich 0,4 bis 0,72 MeV. ***G. Breuer.*** *Zeitschrift für Physik*, v. 154, no. 3, 1959, p. 339-351.

8331* The Relation of the Absorbed Energy and Ionization for Gamma-Quanta With $E\gamma_{max} = 85$ MeV. An investigation of the proportionality between the distribution of the absorbed energy and the distribution of ionization in depth in lead. (*In Russian.*) Sootnoshenie mezdu pogloshchennoĭ energieĭ i ionizatsieĭ dlia γ-kvantov s $E\ \gamma_{max} = 85$ MeV. ***S. P. Kruglov and I. V. Lopatin.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 29, no. 2, Feb. 1959, p. 273-275.

See also: **7402** (concrete shielding); **7412** (neutron attenuation of magnetite concrete); **7413** (properties of graphite); **7414** (radiation techniques in petroleum chemistry); **7674** (neutron detector); **7878** (reactor fuel); **7974** (nuclear power); **7991** (aircraft nuclear propulsion); **7993** (nuclear power supply for manned space vehicles).

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8333* Management's Self-Inflicted Wounds. Discusses the areas of mismanagement caused by the manager himself. ***Charles F. Austin.*** *Army*, v. 9, no. 9, Apr. 1959, p. 37-40.

8334* Mechanized Data Processing as a Tool for Better Management Information. Today, new concepts, new techniques and new equipment for business information processing can make important contributions to management. They offer opportunities not only to explore new territory, but also to retrieve more useful and more meaningful information from the raw material of data already available to us. ***A. W. Hatch.*** *Edison Electric Institute Bulletin*, v. 27, Mar. 1959, p. 88-90.

8335* Trends and Problems in Management. Expansion, diversification, and increasing technology of today's business bring entirely new problems in management not found in smaller, owner-operated industries. Excellent sources for management personnel, the authors find, are men basically trained to be professional managers and mature scientists and engineers who have, as they matured, transferred their work to the administrative side of the business. ***Harold F. Smiddy and Glenn B. Warren.*** *Electric Light and Power*, v. 37, no. 7, Apr. 1, 1959, p. 50 + 4 pages.

8336* The Truth About Wage Incentives and Work Measurement Today. This survey tells how management men in 785 plants see these controversial tools and how they use them. *Factory*, v. 117, Apr. 1959, p. 74-84.

8337 Linear Programming: Fundamentals and Applications. Clearly demonstrates what linear programming can do by showing why linear programming is a significant advance in scientific management, how it helps in selecting, gathering, processing, and interpreting facts and information, and where and how business and management can apply it to problems in industry. ***Robert O. Ferguson and Lauren F. Sargent.*** 342 pp. 1958. McGraw-Hill, New York. (HD31 F38L)

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ORE AND MATERIALS BENEFICIATION

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8342 Macerals. Review and appraisal of more recent studies. ***J. K. Brown.*** *British Coal Utilisation Research Association, Monthly Bulletin*, v. 23, Jan. 1959, p. 1-17.

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8349 Mineral Dressing Fundamentals Applied to the Fine Coal Problem. Flowsheet of Crucible's fine coal plant. ***M. C. Chang and John Dasher.*** *Mining Engineering,* v. 11, Mar. 1959, p. 304-306.

8350 Processing California Bastnasite Ore. Discussion of the nitric acid process under the headings: calcination of the ore, leaching of calcine, filtration, solvent extraction, and acid recovery. ***Charles J. Baroch, Morton Smutz, and Edwin H. Olson.*** *Mining Engineering,* v. 11, Mar. 1959, p. 315-319.

8351 Interaction of Minerals With Gases and Reagents in Flotation. The behavior of minerals depends on the concentration of oxygen in solution, both in sulfide minerals and in nonsulfides. Crystal structure is also a major factor in their response to variations in oxygen level. ***Igor Plaksin.*** *Mining Engineering,* v. 11, Mar. 1959, p. 319-324.

8352 Experiments in Concentrating Iron Ore From the Pea Ridge Deposit, Missouri. Mineral dressing research showed that iron concentrates of commercial quality could be produced from deposit near Sullivan, Mo. Magnetic separation and flotation, on a laboratory scale, yielded concentrates ranging from 60.0 to 71.4% Fe at recoveries of 89.9 to 97.6%. ***M. M. Fine and D. W. Frommer.*** *Mining Engineering,* v. 11, Mar. 1959, p. 325-328.

8353* Pyrite Treated in Kennecott Reactor. A 20-foot diameter reactor produces SO_2 and hematite calcine for a contact acid plant and for a sponge iron plant. Both products are essential for the leach-precipitation-flotation process at Hayden, Arizona. ***Henry W. Franz.*** *Mining World,* v. 21, no. 4, Apr. 1959, p. 30-31.

8354* Sulphatizing Copper Sulphides. A description of operating variables during a 16-month pilot plant campaign using a 5-foot Dorrco FluoSolids reactor. ***Edward S. Howell.*** *Mining World,* v. 21, no. 4, Apr. 1959, p. 31-32.

8355* Continuous Calcination of Limestone for Adding Lime to Sintering Mixture. A circular furnace with the revolving grate, designed for continuous and rapid calcination of limestone and adding the burnt lime to the sintering mixture, may be readily incorporated with the flowsheet of a sintering plant. Productivity of sintering machines, and the working conditions in the blending departments of sintering plants. (*In Russian.*) Nepreryvnyĭ obzhik izvestniaka dlya aglomeratnonnoĭ shkhty. ***G. G. Oreshkin, N. Z. Plotkin, and A. K. Rudkow.*** *Stal',* v. 19, no. 3, Mar. 1959, p. 197-203.

8356 McLouth Joins Trend: Builds Self-Fluxing Sinter Plant. Facility turns out 2100 tons a day. Limestone is incorporated into the mix, to avoid separate charging. Unit also reclaims flue dust. *Steel,* v. 144, Apr. 6, 1959, p. 154 + 1 page.

8357* The Mechanism of Oxidized Sintering of Iron Ores. (*In Japanese.*) ***Teruo Ikeno, et al.*** *Tetsu to Hagané (Journal of th Iron and Steel Institute of Japan),* v. 45, no. 3, Mar. 1959, p. 179-181.

8358* Progress in Scientific Research and in the Practice of Ore Dressing. Recent developments in this field. (*In Russian.*) Itogi raboty v oblasti nauki i vnedreniia dostizheniĭ v tekhnike obogashcheniia rud. ***I. N. Plaxin.*** *Tsvetnye Metally,* v. 32, no. 2, Feb. 1959, p. 4-9.

8359* Producing Conditional Molybdenite Concentrates From the Collective Sulphide-Oxide Products, Treated by Flotation in the Presence of Oleic Acid. Describes two flotation methods and discusses causes for the flotation of sulfides in an acidified medium. (*In Russian.*) Poluchenie molibdenitovykh konditiomykh kontsentra tov iz kollektivnykh sul'fidno-okislennykh produktov sflotirovannykh oleinovoĭ kislotoĭ. ***L. I. Brosman.*** *Tsvetnye Metally,* v. 32, no. 2, Feb. 1959, p. 10-13.

8360* Jigging Conditions for Getting Coarse-Grained Undersize Concentrates. Improving the operation of jigging machines for enriching sands containing rare metals with the purpose of reducing the water consumption in jigging coarse-grain material. (*In Russian.*) Usloviia otsadki dlya polucheniia krupnozernistykh podreshetnykh kontsentratov. ***N. P. Sannikova.*** *Tsvetnye Metally,* v. 32, no. 2, Feb. 1959, p. 14-16.

8361 A Process for Controlling Insoluble Uranium in Ore Concentrates. Two methods for determining insoluble U in feeds: acid dissolution of the feed, fusion of the insoluble material with potassium pyrosulfate, and spectrophotometric determination of U; acid dissolution of the feed and titrimetric determination of U in the insoluble portion. ***W. M. Wise and W. C. Stoecker.*** *U. S. Atomic Energy Commission, MCW-*1423, Feb. 2, 1959, 19 pp. (UF767 Un3.1mc Contin.)

8362 Synergistic Uranium Extractants: Combination of Neutral Organophosphorus Compounds With Dialkylphosphoric Acids. Dialkylphosphoric acids in combination with trialkylphosphates, dialkyl alkylphosphonates, trialklyphosphine oxides, and other neutral organophosphorus compounds have U extraction abilities as much as two orders of magnitude stronger than the cumulative abilities of the individual reagents. Extractions can be achieved from sulfate and phosphate solutions in addition to nitrate solutions. The reagents allow high U concentration from very low-grade liquors and are usable with liquors usually difficult to extract. ***C. A. Blake, D. E. Horner, and J. M. Schmitt.*** *U. S. Atomic Energy Commission, ORNL-*2259, Feb. 25, 1959, 42 pp. (UF767 U3o Contin.)

See also: **7423** (mechanism of plutonium nitrate extraction); **7444** (U and Th purification); **7477** (froth flotation); **7482** (insoluble U ore treatment); **7916** (diamond mining methods).

PHYSICS

8363 Study of Temperature Variation of Ultrasonic Velocities in Some Organic Liquids by Modified Fixed-Path Interferometer Method. Temperature variation of ultrasonic velocity in a few organic liquids have been studied by the above. ***K. Subba Rao and B. Ramachandra Rao.*** *Acoustical Society of America, Journal,* v. 31, Apr. 1959, p. 439-441.

8364* On Heat Phenomena on Rotating Bodies in Free Molecule Flow. Heat transfer phenomena on rotating sphere and cylinder when the bodies are subject to both rotational and translational motions. No radiation phenomena are considered. ***M.Z.v. Krzywoblocki and R. E. Bloomquist.*** *Acta Physica Austriaca,* v. 12, no. 3, Mar. 1959, p. 237-245.

8365* Rigorous Solution of Einstein's Unified Theory for a Special Type of Symmetry. Solution of Einstein's unified field equations in the "weaker form" with certain restrictions has been obtained corresponding to the infinite plane of the general relativity with both electric and magnetic fields present. ***J. R. Rao.*** *Acta Physica Austriaca,* v. 12, no. 3, Mar. 1959, p. 251-261.

8366* Modified Bohm and Pines Collective Description of Electron Interactions in Crystals. I. In order to remove the difficulties in normalizing the state vectors, a set of new subsidary conditions is proposed in which the Bohm–Pines theory may be taken as correct for any desired degree of accuracy.

A mathematical development. ***Jan Śledzik.*** *Acta Physica Polonica,* v. 17, no. 6, 1958, p. 463-479.

8367* Radiation From a Modulated Beam of Charged Particles When Passing Through a Circular Hole in a Plane Screen. Calculation of the radiation produced by an electron beam in an infinitely thin, ideally conducting, screen was made within a speed range of $\beta = 0.1$ to $\beta = 0.99$ ($\beta = v/c$) by deriving an integral equation on the electron machine. (*In Russian.*) Izluchenie modulirovannogo puchka zariazhennykh chastits pri prolete cherez krugloe otverstie v ploskom ekrane. ***Iu. N. Dnestrovskiĭ and D. P. Kostomarov.*** *Akademiia Nauk SSSR, Doklady,* v. 124, no. 4, Feb. 1, 1959, p. 792-795.

8368* Theory of the Electric Discharge in a Moving Conducting Medium. Study of a new type of discharge compression that can be used to obtain high temperatures. (*In Russian.*) Teoriia elektricheskogo razriada v dvizhushcheĭsia provodiashcheĭ srede. ***V. N. Zhigulev.*** *Akademiia Nauk SSSR, Doklady,* v. 124, no. 6, Feb. 21, 1959, p. 1226-1228.

8369* Investigation of the Fine Structure of X-Ray Absorption Spectra of Iron in Some Antiferromagnetics and Ferrites. Tests indicated that the wavelength of the first absorption maximum and the position of the intermediate point of the region of absorption of iron in α-Fe_2O_3 and in the ferrites investigated practically do not depend on the magnetic composition of the substance nor on the nature of the bivalent metal. (*In Russian.*) Issledovanie tonkoĭ struktury rentgenovskikh spektrov pogloshcheniia zheleza v nektotorykh antiferromagnetikakh i ferritakh. ***E. E. Vaĭnshtein, B. I. Kotliar, and G. A. Shapiro.*** *Akademiia Nauk SSSR, Doklady,* v. 125, no. 1, Mar. 1, 1959, p. 55-58.

8370 Modified Helical Method for Determining *e/m*. Method is modified by substituting alternating current in the solenoid and simultaneously supplying a voltage to the deflection plates proportional to the solenoid current. ***Bernard L. Miller.*** *American Journal of Physics,* v. 27, no. 4, Apr. 1959, p. 256-259.

8371* Gravitational Radiation of Temporarily Unsteady System. Weyl's integral form of the general-relativistic energy-impulse law was used in order to show that the gravitational radiation emitted by a temporarily unsteady system possesses a non-disappearing total energy that cannot be further transformed. (*In German.*) Die Gravitationsstrahlung eines zeitweilig nichtstationären Systems. ***D. Geissler, A. Papapetrou, and H. Treder.*** *Annalen der Physik,* v. 2, nos. 7-8, Jan. 1959, p. 344-350.

8372* On Flammersfeld's Range-Energy Relation for Electrons. Flammersfeld range-energy relation for electrons in aluminum has been examined. It is found that it is satisfactory for $E > 0{,}2$ Mev. For lower energies a power relation $E = C\,R^m$ is suitable. $dE\,dR$ as calculated from these equations differs considerably from the theoretical results. Possible reasons for the discrepancy have been discussed. ***Yatendra Pal Varshni and Ramesh Chandra Karnatak.*** *Annalen der Physik,* v. 2, nos. 7-8, Jan. 1959, p. 413-420 .

8373* Pulsating Fluid Sphere in General Relativity. The note presents a solution of the Einstein gravitational equations representing a pulsating fluid sphere in an outside empty space. ***Priyansu Sen Gupta.*** *Annalen der Physik,* v. 2, nos. 7-8, Jan. 1959, p. 421-424.

8374* Some New Conservation Laws. Presents the "conservation of metricity" law which is valid regardless of any interaction of the metric field with other fields and regardless even of the equation of motion assumed for the metric field itself. ***David Finkelstein and Charles W. Misner.*** *Annals of Physics,* v. 6, Mar. 1959, p. 230-243.

8375* Implications of Parity Nonconservation and Time Reversal Noninvariance in Electromagnetic Interactions. ***Mendel Sachs.*** *Annals of Physics,* v. 6, Mar. 1959, p. 244-260.

8376 Production of X-Rays During a Low-Pressure Gas Discharge. Shows that any of several gases may be used, although the optimum pressure for maximum output varies from gas to gas. Because of the better focusing properties of the heavier gases, it is possible to work with them at higher voltages without external breakdown of the discharge tube. ***R. F. Thumwood.*** *British Journal of Applied Physics,* v. 10, Mar. 1959, p. 147-151.

8377* Field Emission From Semiconductors. Field emission of electrons under the action of an intense electric field is vital in understanding the surface properties of solids, particularly semiconductors. Experiments have confirmed the characteristic exponential relation between the emission current and the field strength but it has not yet been possible to prove the emission law. ***G. Busch and T. Fischer.*** *Brown Boveri Review,* v. 45, nos. 11/12, Nov./Dec. 1958, p. 532-539.

8378 Cryogenic Engineering. Clearly covers the entire range of cryogenic engineering describing in easy form the development and improvement of low-tempearture processes and equipment; the determination of the physical properties of materials used to produce, maintain, and utilize low temperatures; and applications of cryogenic techniques. Problems in this field receive careful attention. ***Russell B. Scott.*** 368 pp. 1959. D. Van Nostrand Co., New York. (QC278 Sco85c)

8379 Ultrasonic Atomization of Liquids. Films atomized under ultrasonic excitation, and by rupture of capillary waves in the film is suggested as the prime cause of atomization. High-speed motion pictures show sprays emanating from vibrating gas bubbles in the paint film. The particles produced were from 5μ to 500μ in diameter. Under the best atomizing conditions at 20 kc, the particle diameters were from 20μ to 70μ. ***John N. Antonevich.*** *IRE Transactions on Ultrasonics Engineering, PGUE-7,* Feb. 1959, p. 6-15. (TK1 In6.6u Vis.)

8380 Depolarized Components of Light Scattered by Glasses. I. Measurements on Twelve Optical Glasses. II. Influence of Nonannealable Strains on the Scattering. Concludes that light scattering does not distinguish a glass from a liquid. The fact that *ph* is unity in vitreous silica is an argument against the existence of domains. ***Martin Goldstein.*** *Journal of Applied Physics,* v. 30, Apr. 1959, p. 493-506.

8381 X-Ray Integrated Intensity of Germanium Effect of Dislocations and Chemical Impurities. Presumes that the strains caused by the impurity atoms are responsible for the increased intensity. ***Boris W. Batterman.*** *Journal of Applied Physics,* v. 30, Apr. 1959, p. 508-513.

8382 Superposition of Configurations and Natural Spin Orbitals. Applications to the He Problem. Superposition is examined in two cases: a 21 x 21 matrix including all configurations up to $(6s)^2$, and a 20 x 20 matrix with all configurations up to the 4-quantum level, including angular terms. ***Harrison Shull and Per-Olov Löwdin.*** *Journal of Chemical Physics,* v. 30, Mar. 1959, p. 617-626.

8383 Optical Activity in Absorbing Media. Certain dispersion formulas, relating the ellipticity and molecular rotation of optically active solutions, are derived. Analogies are cited. ***William Moffitt and Albert Moscowitz.*** *Journal of Chemical Physics,* v. 30, Mar. 1959, p. 648-660.

8384 General Approach to the Study of Electrical Conductance and Its Relation to Mass Transport Phenomena. A method of writing phenomenological equations for the description of electrical and mass transport, based on approaches of Onsager and of Klemm, is shown to give rise to a set of coefficients defined in a particularly useful and economical way. ***Richard W. Laity.*** *Journal of Chemical Physics,* v. 30, Mar. 1959, p. 682-691.

8385 Energetic Species Trapped at 4.2°K From Gaseous Discharges. A number of difficulties have been recognized in the calorimetric technique developed by Broida and Lutes for estimating the abundance of trapped atoms and an apparatus has been constructed which embodies a compromise of the various requirements. ***G. J. Minkoff, F. I. Scherber, and J. S. Gallagher.*** *Journal of Chemical Physics,* v. 30, Mar. 1959, p. 753-758.

8386* Generalized Heat Transfer Between Solids and Gases Under Nonlinear Boundary Conditions. Concerns a solid body with a given temperature surrounded by a gas of another temperature when heat will transfer through the surface, obeying the Newton law of cooling. ***Avner Friedman.*** *Journal of Mathematics and Mechanics,* v. 8, no. 2, Mar. 1959, p. 161-183.

8387* **The Electromagnetic Field.** ***Gustave R. Holm.*** *Ohio Journal of Science,* v. 59, no. 2, Mar. 1959, p. 65-70.

8388 The Ratio of the Isolated and the Adiabatic Susceptibility of Paramagnetic Crystals. A derivation is given by means of geometrical arguments which give an insight into the remarkable fact that for so many crystals one finds the same value for the ratio of the two susceptibilities. ***W. J. Caspers.*** *Physica,* v. 25, Jan. 1959, p. 43-49.

8389 Temperature Fluctuations in Thermodynamic Equilibrium. Fluctuations in a system are calculated in such a way as to remove certain objections. ***R. M. Mazo.*** *Physica,* v. 25, Jan. 1959, p. 57-59.

8390 New Solutions of the Molecular Field Equations for Antiferromagnetism in an Orthorhombic Crystal at Zero Temperature. Analyzed for an external field applied parallel to the axis preferred for anti-ferromagnetic alignment or to the next preferred axis. ***Olga P. Van Wier, Tineke Van Peski-Tinbergen, and C. J. Gorter.*** *Physica,* v. 25, Feb. 1959, p. 116-132.

8391 On the Theory of Brownian Motion. Shows that the non-Gaussian-Markoff process is related through a transformation of variables to the Gaussian-Markoff process on the conventional phenomenological theory of Brownian motion. ***P. Mazur.*** *Physica,* v. 25, Feb. 1959, p. 149-162.

8392 Simplified Treatment for Strong Short-Range Repulsions in *N*-Particle Systems. I. General Theory. A new variational approach is developed for studying the properties of systems of particles interacting through singular short-range repulsions that give rise to strong two-particle correlations. ***John W. Clark and Eugene Feenberg.*** *Physical Review,* v. 113, 2nd ser., no. 2, Jan. 15, 1959, p. 388-399.

8393 Neutron Diffraction Investigations of the Magnetic Ordering in $FeBr_2$, $CoBr_2$, $FeCl_2$, and $CoCl_2$. ***M. K. Wilkinson, J. W. Cable, E. O. Wollan, and W. C. Koehler.*** *Physical Review,* v. 113, 2nd ser., no. 2, Jan. 15, 1959, p. 497-507.

8394 Guided Propagation in a Slowly Varying Medium. Some simple formulae for wave propagation are derived. The ideas are applied to the propagation of sound (especially underwater), shear wave, and electromagnetic radiation, and the present limitations of the method indicated. ***D. E. Weston.*** *Physical Society, Proceedings,* v. 73, pt. 3, Mar. 1959, p. 365-384.

8395 The Theory of Electrical and Photoelectric Effects for Three Carriers in a Magnetic Field. Formulae for the Hall, magnetoresistance, photoelectromagnetic and Dember effects due to electrons and slow and fast holes are derived for the cases of energy independent relaxation time and lattice scattering. Germanium is discussed in particular. ***A. K. Walton and T. S. Moss.*** *Physical Society, Proceedings,* v. 73, pt. 3, Mar. 1959, p. 399-412.

8396 Spin-Orbit Coupling and the Extraordinary Hall Effect. Conventional quantum-mechanical transport theory is used in some quantitative detail to evaluate the actual magnitude of the extraordinary Hall coefficient. ***C. Strachan and A. M. Murray.*** *Physical Society, Proceedings,* v. 73, pt. 3, Mar. 1959, p. 433-447.

8397 Van der Waals Forces. Discusses measurements of elastic scattering of the alkali metals by the inert gases and concludes that the normal van der Waals interaction does not suffice to explain the observations at very low scattering angles. ***A. Dalgarno and A. E. Kingston.*** *Physical Society, Proceedings,* v. 73, pt. 3, Mar. 1959, p. 455-464.

8398 An Arc Maintained on an Isolated Metal Plate Exposed to a Plasma. Shows theoretically that a cathode spot may be maintained on an isolated metal surface immersed in the plasma of a gas discharge. Two experiments are described. ***A. E. Robson and P. C. Thonemann.*** *Physical Society, Proceedings,* v. 73, pt. 3, Mar. 1959, p. 508-512.

8399* Quantum Field Theory in Terms of Euclidean Parameters. Shows that this theory is equivalent to the conventional one in terms of the Minkowski parameters, if we confine ourselves to the case of local fields. ***Tadao Nakano.*** *Progress of Theoretical Physics,* v. 21, no. 2, Feb. 1959, p. 241-259.

8400 Production and Measurement of High Temperatures. A study of thermally excited plasmas with temperatures in the range of 10,000-70,000 K. The measurement of these temperatures can be effected by observation of lines or of continuous radiation emitted from the plasma. ***W. Lochte-Holtgreven, R. Schall, and F. Wecken.*** Paper from "Reports on Progress in Physics", v. XXI, p. 312-383. 1958. The Physical Society, London. (QC3 P56r Vis.)

8401 Some Optical Characteristics of Semiconductors. Optical phenomena are described, together with discussion of the electronic structure of semiconductors to show what kind of information can be derived from the measurements. ***O. Simpson.*** *Research,* v. 12, Apr. 1959, p. 127-132.

8402* Study and Construction of a System for the Correction of the Residual Aberrations of a Wide-Aperture Spherical Mirror. Correction of mirror spherical aberration is obtained by using a set of two complementary aspherical plates cemented together, the refractive indexes being somewhat different. The major merit of the system is, as calculation shows, that plate-cutting accuracy requirements depend only upon the difference between the respective indexes of the two plates. Assuming a difference in the order of 5.10^{-4}, the accuracy requirement is approximately 0.03 mm, a degree of precision that can be easily achieved by purely mechanical means, without final correction. With Schmidt plates of conventional type, the accuracy requirement would have been 0.2μ. (*In French.*) Étude et réalisation d'un système correcteur des aberrations résiduelles d'un miroir sphérique très ouvert. ***Jacques Pouleau.*** *Revue d'Optique Théorique et Instrumentale,* v. 37, no. 12, Dec. 1958, p. 577-597.

8403 The Elastic Scattering of Fast Electrons and Positrons by Hydrogen and Helium Atoms. A simplification of the second Born approximation is used to calculate the differential cross-sections for the above scattering. ***B. L. Moiseiwitsch and A. Williams.*** *Royal Society, Proceedings,* v. 250, ser. A, Mar. 24, 1959, p. 337-345.

8404 Reconcilation of Two-Dimensional ("Cross-Grating") and Three-Dimensional Phenomena in Electron Diffraction and Resolution of Other Anomalies on the Basis of Bragg Reflexions From Single Crystal Lamellae Suffering Radially Progressive Shear Strain. ***F. W. Cuckow.*** *Royal Society, Proceedings,* v. 250, ser. A, Apr. 7, 1959, p. 439-459.

8405* The Practice and Application of Nuclear Resonance Spectroscopy. Applications are reviewed, and the spectroscopic technique is discussed. ***R. E. Richards.*** *Spectrochimica Acta,* v. 14, Jan. 1959, p. 5-16.

8406 Theoretical Electromagnetism. Provides a concise introduction to the essentials of electromagnetic theory with examples of its application. Vector methods and the four-dimensional Giorgi system of units have been adopted. ***W. R. Myers.*** 274 pp. 1958. Butterworths Scientific Publications, London. (QC518 M99t)

8407 Transport Processes in Statistical Mechanics. Proceedings of the International Symposium held in Brussels, Aug. 27-31, 1956. ***I. Prigogine, editor.*** 436 pp. 1958. Interscience Publishers, New York. (QC175 In8p)

8408* Propagation of Electromagnetic Waves in Molecular Crystals With Weak Exciton-Photon Interaction. II. Natural Optical Activity. On the basis of results obtained in the preceding study, the author calculated the gyration vector for molecular crystals in which excitons arise in the case of a weak coupling of the exciton excitation with the lattice vibrations and an arbitrary value of the coefficient of absorption. (*In Ukrainian.*) Poshirennia elektromagnitnikh khvil' v melekuliarnikh kristalakh pri slabkiĭ eksiton-fononniĭ vzaemodiĭ. II. Prirodna optichna aktivnist'. ***A. F. Lubchenko.*** *Ukrains'kiĭ Fizichniĭ Zhurnal,* v. 3, no. 6, Nov.-Dec. 1958, p. 701-711.

8409 Some Experiments on Electrical Conduction in Vacuum. Conduction was investigated in high voltage generators using beta emitters as current sources. The adsorption of contaminants on electrode surfaces was found to decrease

the voltage at which appreciable vacuum conduction began to occur. ***Joseph W. Kennedy, et al.*** *U. S. Atomic Energy Commission, AECU-3989*, Dec. 1957, 64 pp. (UF767 U3au Contin.)

8410* Some Problems of the Luminescence of Crystals. It is shown the excitons originating in a crystal at absorption of light annihilate without radiation either in the basic lattice or on the admixtures and defects. In the latter case, luminescence of the admixture can be excited. Thus, the length of the diffusion shift of excitons depends upon the structure. It cannot be considered as a constant of a given substance and depends upon the purity of the crystal and the perfection of its lattice. (*In Russian.*) Nekotorye voprosy liuminestsentsii kristallov. ***V. L. Broude, A. F. Prikhot'ko, and E. I. Rashba.*** *Uspekhi Fizicheskikh Nauk*, v. 67, no. 1, Jan. 1959, p. 99-117.

8411* Relationship Between the Magnetic Aftereffect- and Hysteresis Losses in Ferrites. (*In German.*) Eine Beziehung zwischen magnetischen Nachwirkungs- und Hystereseverlusten bei Ferriten. ***Werner Metzdorf.*** *Zeitschrift für Angewandte Physik*, v. 11, no. 3, Mar. 1959, p. 95-102.

8412* A Contribution to the Internal Field Emission Theory. In quantum mechanics treatment of the internal field emission, the potential component of the electrical field disturbs the periodicity of the Schrödinger equation; thus, an infinite basic field must be selected in order to solve the equation by means of the Houston functions. This paper shows a method to eliminate the nonperiodic potential component. (*In German.*) Zur Theorie der inneren Feldemission. ***Josef Kamphusmann.*** *Zeitschrift für Naturforschung*, v. 14a, Feb. 1959, p. 165-171.

8413* A Contribution to the Elastic Scattering of Slow Electrons in the Field of an Atom Applied to the *p*-Scattering of an Electron in the Field of the Atomic Hydrogen. A method to calculate the scattering of slow electrons along with the well-known methods of Hulthen and Kohn are applied to calculate *p*-wave scattering in the normal hydrogen field. The new method avoids the ambiguity of Hulthen's quadratic equation and gives almost the same result. (*In German.*) Zur elastischen Streuung langsamer Elektronen im Feld eines Atoms. ***F. B. Malik.*** *Zeitschrift für Naturforschung*, v. 14a, Feb. 1959, p. 172-193.

8414* A Contribution to the Quantum Mechanics Theory of the Dielectric Oriented Polarization of Gases. II. The Oriented Polarization of a Dipole Gas Consisting of Symmetrical Spinning Molecules, in the Electrical Alternating Field. (*In German.*) Zur quantenmechanischen Theorie der dielektrischen Orientierungspolarisation von Gasen. II. Die Orientierungspolarisation eines aus symmetrischen Kreiselmolekülen bestehenden Dipolgases im elektrischen Wechselfeld. ***Wilhelm Maier and Hermann K. Wimmel.*** *Zeitschrift für Physik*, v. 154, no. 2, 1959, p. 133-149.

8415* Fixation of Ion and Electron Images Without Granulation and With High Resolving Power by Means of Photooptical Interference Filters. Development and physical bases of a new method permitting a granulation and resolving power limit of the plate lower than the resolving power of the optical microscope used in the examination. Thus, the grain must be below 0.2μ. (*In German.*) Kornlose und höchstauflösende Fixierung von Ionen- und Elektronenbildern mittels lichtoptischer Interferenzfilter. ***R. Speidel.*** *Zeitschrift für Physik*, v. 154, no. 2, 1959, p. 238-263.

8416* Electric Discharge With Cold Cathode in Magnetic Field at Low Pressure. Theoretical evaluation of the kinetics of the electrons in the case of the absence of field distortion by means of volume charges. Experimental distribution of the potential electron paths with arbitrary initial coordinates and speeds at different relationships of the electric and magnetic fields. (*In Russian.*) Elektricheskiĭ razriad s kholodnym katodom pri nizkikh davleniiakh v magnitnom pole. ***G. V. Smirnitskaia and E. M. Reĭkhrudel'.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 29, no. 2, Feb. 1959, p. 153-162.

8417* The Gas Parameters After a Shock Wave. A study showing that in calculating the varying thermal capacity, the parameters in question are determined by an effective γ^1. In the case of a low dissociation energy, a crossing is possible between the corresponding frozen and equiponderant shock adiabates and the shock fields. (*In Russian.*) Parametry gaza za udarnoĭ volnoĭ. ***Iu. P. Lun'kin.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 29, no. 2, Feb. 1959, p. 180-188.

See also: **7708** (electrospherics); **7814** (plasma resonance).

PLASTICS

8418* Developments in Non-Metallic Aircraft Materials. Glass reinforced synthetic resin laminate materials and foamed plastics for aircraft use are broadly surveyed. Illustrations of the use of polyester laminates and foamed polystyrene are included. ***H. Bellamy.*** *Aircraft*, v. 38, no. 6, Mar. 1959, p. 27 + 4 pages.

8419* An Investigation of the Deformation of Polyethyleneterphthalate Crystal Films. (*In Russian.*) Issledovanie deformatsii kristallicheskikh plenok iz polietilentereftalata. ***P. V. Kozlov, V. A. Kabanov, and A. A. Frolova.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 1, Mar. 1, 1959, p. 118-121 + 1 plate.

8420* Carbon-Chain Polymers and Copolymers. VI. Synthesis and Polymerization of 1,1-Dichloro-2-fluoroethylene. In synthesizing this compound, it was shown that it polymerizes on heating in the presence of benzoyl peroxide. (*In Russian.*) Karbotsepnye polimery i sopolimery. VI. Sintez i polimerizatsiia 1.1-dikhlor-2-ftoretilena. ***G. S. Kolesnikov and M. G. Avetian.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1959, no. 2, Feb., p. 331-334.

8421 The Polymerization of Styrene by *n*-Butyllithium. Rate of polymerization of styrene initiated by *n*-butyllithium has been studied at temperatures from 20 to 50 C in benzene and toluene solution. ***F. J. Welch.*** *American Chemical Society, Journal*, v. 81, Mar. 20, 1959, p. 1345-1348.

8422 Anionic Copolymerization of Isoprene and Styrene. I. Lithium, *n*-butyllithium, and Na were used to catalyze the polymerization of equimolar mixtures of isoprene and styrene in various solvents. ***Donald J. Kelley and Arthur V. Tobolsky.*** *American Chemical Society, Journal*, v. 81, Apr. 5, 1959, p. 1597-1600.

8423* Castor Polyols for Urethane Foams. Systematic investigation of some 21 castor polyols as base materials for preparing urethane foams. ***A. Ehrlich, M. K. Smith, T. C. Patton.*** *American Oil Chemists' Society, Journal*, v. 36, Apr. 1959, p. 149-154.

8424 Resin-Glass Bond Characteristics. Three methods to measure the mechanical strength of the joint between cast resins and single glass elements. ***F. J. McGarry.*** *ASTM Bulletin*, no. 235, Jan. 1959, p. 63-68.

8425 Alkoxides as Initiators of Anionic Polymerisation of Vinyl Monomers. I. Polymerisation of Acrylonitrile by Use of Sodium Alkoxides. ***Albert Zilkha, Ben-Ami Feit, and Max Frankel.*** *Chemical Society, Journal*, 1959, Mar., p. 928-933.

8426 The Polymerisation of Acetylene Derivatives. I. The Polymerisation of Some Monomers Derived From Vinylacetylene. Polymerization of *p*-[1-(3'-buten-1'-ynyl)cyclohexyl]phenyl acetate and of the corresponding anisole by benzoyl peroxide. ***A. C. Davis and R. F. Hunter.*** *Journal of Applied Chemistry*, v. 9, pt. 3, Mar. 1959, p. 137-141.

8427* High-Energy Radiation Effects on Polyacrylates and Polymethacrylates. Chemical and physical changes produced in polymethacrylates and polyacrylates by ionizing radiations are examined in the light of data revealing molecular structural changes and ultimate fragmentation products. ***Allan R. Shultz.*** *Journal of Polymer Science*, v. 35, Mar. 1959, p. 369-379.

8428* Occurrence of Globular Formations in Thermosetting Resins. Electron-microscopic examination discloses the existence of globular formations, or micelles, in thermosetting

resins, varying in apparent diameter from 400-900 A. ***Edward H. Erath and Robert A. Spurr.*** *Journal of Polymer Science*, v. 35, Mar. 1959, p. 391-399.

8429* Hostalen PPH—Low Pressure Polypropylene for Injection Molding. Properties and characteristics of Hostalen PPH; factors of particular interest to the molder using a high melting point material, namely, the relation between certain mechanical properties and temperature. (*In German.*) Hostalen PPH–Niederdruckpolypropylen für die Spritzgussverarbeitung. ***A. Schley and F. Schülde.*** *Kunststoffe*, v. 49, Mar. 1959, p. 102-108.

8430* Long-Term Behavior of Polyethylene and PVC Pipes. Long-term tests carried out on normal and low-pressure polyethylene pipes. (*In German.*) Zeitstandverhalten von Rohren aus Polyäthylen und Polyvinylchlorid. ***Hans Niklas and Kurt Eifflaender.*** *Kunststoffe*, v. 49, Mar. 1959, p. 109-113.

8431 Dimensional Stability of Plastics at High Temperatures. Previously unpublished data on shrinkage of thermosetting molded plastics after thermal aging. ***J. Chottiner.*** *Machine Design*, v. 31, Apr. 16, 1959, p. 171-174.

8432* Studies on the Polymerisation of Vinyl Esters of Higher Fatty Acids. I. Polymerisation of Vinyl *n*-Butyrate, Vinyl Isobutyrate, Vinyl *n*-Caproate and Vinyl Isocaproate. II. Polymerisation of Vinyl Esters of *n*- and *iso*-Butyric Acid and *n*- and *iso*-Caproic Acid in Benzene Solution. III. Copolymerisation of Vinyl *iso*-Caproate With Vinyl Acetate and Ethylene. ***C. J. Kurian and M. S. Muthana.*** *Makromolekulare Chemie*, v. 29, nos. 1-2, Jan. 1959, p. 1-29.

8433 What's New in Plastics for Engineering Uses. New types of plastics; glass microballoons for foams; properties of polyethylene blends; more data on ablation. ***Malcolm W. Riley.*** *Materials in Design Engineering*, v. 49, Apr. 1959, p. 105-107.

8434* Plastics Engineering 1957-1958. A Review of Developments. A review of developments in materials including polyethylene, polypropylene, polystyrene, acrylates, wear and phenolics, polyesters, fluorocarbons, polyethylene oxide, polycarbonates, polyformaldehyde, and polyurethanes; new products including plastic fibers and containers, plastic pipe, reinforced plastics, foamed plastics and adhesives; and engineering properties. ***R. I. Leininger and R. A. Clark.*** *Mechanical Engineering*, v. 81, Mar. 1959, p. 54-57.

8435 Automatic Film Feeding. Mechanical research has resulted in the development of a simple, effective means of controlling a soft plastic film in a packaging machine at high web speeds. ***D. R. Forry.*** *Modern Packaging*, v. 32, no. 8, Apr. 1959, p. 206-208.

8436 The Urethanes Group Up. I. Latest developments in materials, processing machinery, and markets for urethane foams. *Modern Plastics*, v. 36, no. 7, Mar. 1959, p. 91-96.

8437 Problems With Premix Moldings. I. Strength variations and voids—their causes and cures. ***R. B. White and R. S. Jackson.*** *Modern Plastics*, v. 36, no. 7, Mar. 1959, p. 117 + 7 pages.

8438 Working With Polycarbonate Resin. Practical operating data on injection molding, extruding, machining, finishing, and bonding of this new thermoplastic. ***E. F. Fiedler, W. F. Christopher, and T. R. Calkins.*** *Modern Plastics*, v. 36, no. 8, Apr. 1959, p. 115 + 4 pages.

8439 Behavior of Reinforced Plastics at Very High Temperatures. II. Systematic study of the physical nature of the damage to selected reinforced phenolic plastics in high temperature environments. Tests were made in the plasma of a water-stabilized arc at temperatures up to 23,400 F. ***I. J. Gruntfest, L. H. Shenker, and V. N. Saffire.*** *Modern Plastics*, v. 36, no. 8, Apr. 1959, p. 137 + 7 pages.

8440 Mixed Polyamides Containing Piperazine. In a search for wire and cable jackets having improved flexibility and increased resistance to outdoor aging, emphasis was directed towards systems containing either aromatic or heterocyclic groupings. The materials most thoroughly studied were nylon formulations containing piperazine, a heterocyclic secondary diamine. ***C. W. Hamilton and M. M. Epstein.*** *Modern Plastics*, v. 36, no. 8, Apr. 1959, p. 150 + 4 pages.

8441 The Testing of Plastics Pipes. Three definitive reports on results of long time tests on tubes of polythene and polyvinyl chloride; testing of plastics tubes; extrapolation methods—P.V.C. and polythene tubes. *Plastics (London)*, v. 24, Apr. 1959, p. 147-156.

8442 Properties of Polyethylene and Related Polymers. Methods of synthesis. Physical and mechanical properties of polyethylene are determined by the structure and crystallinity. The structure of polyethylene, polymethylene, and related polymers are compared. ***Chonon Heller, Saul Levinson, and Carole Nudelman.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Note* 57-430, Apr. 1957, 46 pp. (TL507 Un3.18t Contin.)

8443 Review of Structural Plastics. Includes papers on high temperature polyester resins, laminating resins containing silicon, phenyl silane resins, glass flake reinforced plastics, reinforced plastic laminates, rain erosion problems, and a summary of other Wright Air Development Center work on reinforced plastics. *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-555 (Preprint), Sections individually paged. (TL507 Un3.18w Vis.)

See also: **7473** (P.V.C. as a pipe material); **7489** (polythene in water supply); **7597** (fluoroaromatic polymers); **7629** (diffusion in ethylene polymers); **7632**(polyvinyl chloride); **7633** (polyelectrolytes); **7634** (polystyrene); **7661** (chemistry and technology of new synthetic resins); **7685** (vacuum metallizing on plastics); **8493** (bonding of reinforced plastics); **8544** (welding of plastics).

POLLUTION AND WASTES

8444* Ceramic Sponges for Radioactive-Waste Disposal. Liquid radioactive wastes can be soaked up in ceramic sponges, dried, and fired, thus permanently fixing the radionuclides in the ceramic. A highly porous clay body fired to about 800 C is soaked in the liquid waste, dried, and resoaked. The cycle is repeated as often as five times. The clay body is finally fired at 1,300 C to fix the radionuclide permanently. The voids in the sponges may be made by using burnout materials such as naphthalene, wood, cork, or other organic materials. The amount absorbed by the sponge is essentially the same for each of the first four soaking and drying cycles. After four cycles, subsequent cycles absorb considerably less waste. ***C. W. Christenson.*** *American Water Works Association, Journal*, v. 51, Mar. 1959, p. 388.

8445 Cobalt Oxides as Catalysts. Cobalt oxides offer good prospects as materials for catalytic afterburners for motor exhaust gases: in the present state of development, they show a conversion efficiency of almost 100% of organic material and carbon monoxide to carbon dioxide and water for approximately 100 h. before having to be renewed. ***Herbert Schachner.*** *Cobalt*, no. 2, Mar. 1959, p. 37-40.

8446* The Public Water Supply in the Atomic Legislation of the German Federal Republic and Its States. General review of the water contamination problem and discussion of the existing and contemplated legislation on protective measures. (*In German.*) Die öffentliche Wasserversorgung in der Atomgesetzgebung des Bundes und der Länder. ***Kurt Hünerberg.*** *GWF: Gas- und Wasserfach (Wasser Abwasser)*, v. 100, no. 10, Mar. 6, 1959, p. 233-237.

8447 Proceedings of the Twelfth Industrial Waste Conference May 13, 14 and 15, 1957. A three-day meeting held in the Purdue Memorial Union and sponsored by Purdue University and the Indiana State Board of Health. Papers cover various types of wastes connected with reactor fuel processes; oil refinery, air, and water pollution; solid cyanides; dairy and chemical plants. *Industrial Waste Conference, Proceedings, 12th Conference*, 1957, 682 pp. (TD897 In2p Vis.)

8448* Increase of C^{14} in the Atmosphere From Artificial Sources Measured in a California Tree. C^{14} concentrations were measured in various rings of a Ponderosa Pine tree. The increase from 1956 to 1957 was considerably larger than that from 1954 to 1955. ***George S. Bien and H. E. Suess.*** *Zeitschrift für Physik*, v. 154, no. 2, 1959, p. 171-174.

See also: **7940** (ground disposal of radioactive wastes).

RUBBER AND ELASTOMERS

8449* Ultra-Rapid Cold Vulcanisation of Rubber Solutions. The apparatus described has been used to measure accurately the vulcanization times of various types of rubber solution, using sulfur mono- and di-chlorides. ***D. E. Woods and J. E. Roberts.*** *Institution of the Rubber Industry, Transactions*, v. 35, no. 1, Feb. 1959, p. 1-9.

8450* Polymerisation by Mastication of Monomers in Cross-Linked Rubbers. Mastication of rubber vulcanizates containing monomer under suitable conditions causes polymerization of the monomer. ***R. J. Ceresa and W. F. Watson.*** *Institution of the Rubber Industry, Transactions*, v. 35, no. 1, Feb. 1959, p. 19-24.

8451 Isoprene-*d*$_8$ and Other Intermediates for the Synthesis of Deuterio-SN Rubber. ***David Craig, Franz A. Regenass, and Raymond B. Fowler.*** *Journal of Organic Chemistry*, v. 24, Feb. 1959, p. 240-244.

8452* The Diffusion of Sulfur in Rubber With Special Consideration of the Vulcanization Reaction. Special methods, in particular semi-microanalytical, and partly modified methods were applied for determining the free and total S in vulcanizates. The kinetics of the vulcanization reaction of sulfur/rubber compounds prepared on mixing rolls, were studied. Reaction rate, reaction constant, action constant of the Arrhenius' equation, temperature coefficient, and reaction order were determined in dependence on various initial S contents, and also the activation energy of hard rubber vulcanization. (*In German.*) Die Diffusion von Schwefel in Kautschuk unter besonderer Berücksichtigung der Vulkanisations-Reaktion. ***Rudolf Ludwig.*** *Kautschuk und Gummi*, v. 12, Mar. 1959, p. WT59-WT68.

8453* A Study of the Frosting Problem. Frosting is regarded as a consequence of an oxidation reaction caused by the influence of ozone. Effects promoting and retarding frosting and the influence of mixing ingredients are considered. A method is given for quantitative evaluation of the degree of frosting. Various factors influencing frosting are examined and protective measures discussed. (*In German.*) Beitrag zum Frosting-Problem. ***P. Kluckow and E. Seeberger.*** *Kautschuk und Gummi*, v. 12, Mar. 1959, p. WT68 + 6 pages.

8454* Percussion Deformation of Rubber. Method for determining the percussion modulus of rubber on compression. A linear relationship between the kinetic energy and the square of the percussion deformation. (*In Russian.*) Deformatsiia reziny pri udare. ***G. M. Bartenev and N. M. Novikova.*** *Kolloidnyi Zhurnal*, v. 21, no. 1, Jan.-Feb. 1959, p. 3-8.

8455* The Swelling of Vulcanized Rubber in Acetylhydroperoxide Solution. Effect of inhibitors and initiators on the process of swelling of rubber in the benzene and xylene solutions of acetylhydroperoxide. Iron palmitate was shown to have an initiating effect and phenols, amines, and oxyamines an inhibiting action. (*In Russian.*) Nabukhanie vulkanizirovannogo kauchuka v rastvore gidroperekisi atsetila. ***E. N. Novikova.*** *Kolloidnyi Zhurnal*, v. 21, no. 1, Jan.-Feb. 1959, p. 91-96.

8456* The Effect of Viscosity of Rubber Latex on the Rate of Gelatinization. Rate of gelatinization of latex depends not only upon the number of stabilizing ions formed but also upon the rate of their diffusion, determined by the viscosity of the medium. (*In Russian.*) Vliianie viazkosti kauchukovogo lateksa na skorost' zhelatinirovaniia. ***D. M. Sandomirskiĭ and M. K. Vdovchenkova.*** *Kolloidnyi Zhurnal*, v. 21, no. 1, Jan.-Feb. 1959, p. 132-133.

8457 Nitrile Silicone Compounds Are Heat, Oil Resistant. Characteristics and typical applications of three rubbers. *Materials in Design Engineering*, v. 49, Apr. 1959, p. 129-130.

8458* Cold Polymerized Nitrile Rubbers. By designing new catalysts, it was possible to decrease from +50 to 5 C the polymerization temperature of nitrile rubbers. This temperature drop has influenced the molecular structure of the elastomers: higher average molecular mass, lower number of side-chains and branches, and higher copolymerization regularity, resulting in a more regular structure. (*In French.*) Caoutchoucs nitrile polymérisés a froid. ***Claude Thélamon-Meynard.*** *Revue Générale du Caoutchouc*, v. 36, Feb. 1959, p. 196-200.

8459* Effects of Carbon Black on Rubbers for Low Temperature Use. Effect of carbon black type and loading on the temperature-retraction properties of five polymers. ***Fred W. Barlow and Robert W. Cretney.*** *Rubber Age*, v. 85, no. 1, Apr. 1959, p. 82-87.

8460* Vertical Continuous Vulcanizing. A new method of applying rubber insulation to wire. Much of the damage which was formerly inflicted on soft insulation before it was cured can now be eliminated. ***Ben H. Davis.*** *Rubber Age*, v. 85, no. 1, Apr. 1959, p. 88-90.

8461* The Work of Rubber Elongation. Curves of the relation between work of deformation and elongation in a vulcanizate. ***A. B. Kusov.*** *Rubber Chemistry and Technology*, v. 32, no. 1, Jan.-Mar. 1959, p. 40-47. (Translated from *Kauchuk i Rezina*, v. 16, 1957, p. 5-9.)

8462* Vulcanization of Elastomers. 12. Perbunan With Thiuram Monosulfide and Sulfur. I. 20. Sulfur Vulcanization Accelerated With Thiuram Compounds. I. 19. The Function of Oxides in Thiuram Vulcanization. ***Walter Scheele, et al.*** *Rubber Chemistry and Technology*, v. 32, no. 1, Jan.-Mar. 1959, p. 128-163. (Translated from *Kautschuk und Gummi*, v. 10, Mar. 1957, WT 51-57; v. 11, Mar. 1958, WT 51-56; v. 11, Feb. 1959, WT 23-30.)

8463* Vulcanization of Hard Rubber. A study of the properties of hard rubber was made at different stages of vulcanization. Materials tested were hard rubbers based on the butadiene-styrene rubber SKS-30. For comparison, spectra of hard rubbers based on SKB (polybutadiene rubber) and natural rubber were also studied. ***A. S. Kuzminskiĭ and L. V. Borkova.*** *Rubber Chemistry and Technology*, v. 32, no. 1, Jan.-Mar. 1959, p. 195-207. (Translated from *Kauchuk i Rezina*, v. 16, no. 1, 1957, p. 14-22.)

8464* Oxidation-Reduction Systems for Initiation of Radical Processes. VI. Systems Involving Oxygen for Initiation of Oxidative Degradation of Polymers. Mechanism of action of various oxidation-reduction systems containing organic reducing agents, iron salts, and oxygen. Possibility of utilization of these systems for initiation of a chain process of oxidative degradation of unsaturated and some saturated polymers at low temperatures. ***E. I. Tinyakova, B. A. Dolgoplosk, and V. N. Reikh.*** *Rubber Chemistry and Technology*, v. 32, no. 1, Jan.-Mar. 1959, p. 231-243. (Translated from *Izvest. Akad. Nauk, SSSR, Otdel. Khim. Nauk*, 1957, no. 9, p. 1111-1121.)

8465* The Hot Mixing of Rubber. I. Influence of Mixing Conditions on Scorching and on the Physical Properties of the Vulcanizates. ***G. Fromandi and S. Reissinger.*** *Rubber Chemistry and Technology*, v. 32, no. 1, Jan.-Mar. 1959, p. 295-307. (Translated from *Kautschuk und Gummi*, v. 11, no. 1, Jan. 1958, WT 3-8.)

8466* Influence of Accelerator Residues on Age Resistance of Elastomeric Vulcanizates. Relative contribution of network stability and inhibition to the age resistance of diene vulcanizates. ***Z. T. Ossefort.*** *Rubber World*, v. 140, no. 1, Apr. 1959, p. 69-76.

8467* Wing-Stay as an Antioxidant and Antiozonant. ***R. B. Spacht, W. S. Hollingshead, and J. G. Lichty.*** *Rubber World*, v. 140, no. 1, Apr. 1959, p. 81-85.

See also: **7517** (sulfur in accelerators); **8069** ("Vulkollan" synthetic rubber).

SPACE HEATING AND CONDITIONING

8468 Infra-Red Space Heating. Gas-fired radiant heaters are relatively new in the United States. A description of the unit is given and its functioning is described. Industrial applications are presented. ***Marc Resek and Fred J. Prince.*** *Air Conditioning, Heating, and Ventilating*, v. 56, Apr. 1959, p. 74-77.

8469 Commercial Kitchen Ventilation and the Effect of Cooking Appliances on Air Conditioning Design. Basic factors are covered that determine the required capacity for fans installed as part of a kitchen exhaust system. Information is given on how gas or electric cooking appliances affect the ventilation and air conditioning requirements of the kitchen and dining areas. An extensive table is included which gives the maximum heat gain from appliances located in an air conditioned area. ***Edgar A. Jahn.*** *Air Conditioning, Heating, and Ventilating*, v. 56, Apr. 1959, p. 89-96.

8470* Refrigeration in Chemical Engineering. New methods of producing and using refrigeration were presented at Sixth Commission of the Institut International du Froid held under the direction of Prof. K. Nesselmann at Karlsruhe, Germany, Oct. 1958. *British Chemical Engineering*, v. 4, Apr. 1959, p. 208-211.

8471* Heating Schools and Council Buildings. At a recent important conference, various heating systems and fuels were compared for cost and efficiency and the savings effected by proper insulation were discussed. *Fuel Efficiency*, v. 7, Mar. 1959, p. 15-16.

8472* Ducted, Warm Air for Heating Schools, Shops, Homes. An economical method of space heating which is particularly suited for providing intermittent full heating with background warmth, or no heat, at other times. *Fuel Efficiency*, v. 7, Mar. 1959, p. 18-19.

8473* Underfeed Stokers Give More Even Greenhouse Temperatures. ***J. Dorrell.*** *Fuel Efficiency*, v. 7, Mar. 1959, p. 27-28.

8474* Special Emphasis on Problems of Industrial Insulation. The main purpose of the Second Thermal Insulation Conference, to be held on April 9, 1959, is to assist all concerned with the design and construction of industrial buildings to understand the requirements of the new regulations. *Fuel Efficiency*, v. 7, Mar. 1959, p. 49 + 1 page.

8475* Air Conditioning Flexibility: An Economy of Packaged Units. By installing five packaged air conditioning units to cool variously used public areas, New York's Warwick Hotel has (1) achieved more efficient use of its central system to cool 80 private rooms, and (2) reduced its operating costs by more than one-third. *Heating & Air Conditioning Contractor*, v. 50, no. 7, Apr. 1959, p. 52-54.

8476* New Electronic Brain Speeds Blower Testing up to 4000%. A new test apparatus checks on furnace blowers in a few minutes, promises to speed-up product development of an important component in warm-air heating systems. *Heating & Air Conditioning Contractor*, v. 50, no. 7, Apr. 1959, p. 59.

8477 Winning the Air Conditioning Odor Fight. Sources and causes of odors in air-conditioned rooms are described. ***Albert B. Hubbard.*** *Heating, Piping & Air Conditioning*, v. 31, Apr. 1959, p. 118-119.

8478* Predetermination of Luminances by Finite Difference Equations. Luminous flux transfer in an enclosure may be described by a system of linear simultaneous equations which are a finite difference representation of the Fredholm integral equation. Many techniques of numerical analysis, including analogue and digital computers, are applicable to the solution of these equations. ***Philip F. O'Brien and James A. Howard.*** *Illuminating Engineering*, v. 54, Apr. 1959, p. 209-218.

8479* A Flexible Lighting System for a Television Studio. Two groups of rails provide flexibility in locating lights. Lighting is controlled from a production control console. ***William R. Needs and George Gill.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, Mar. 1959, p. 124-126.

See also: **7604** (Freon-23 refrigerant).

TEXTILES, FIBERS, LEATHER, AND PAPER

8480* Strength of Beechwood Impregnated in the Living Tree. Copper nitrate and sulfate, zinc chloride, and nickel sulfate protect the wood against fungi, *Scolytoidea* and *Cossidae*. After being stored 11 months in the open air, the wood of the impregnated trees showed higher indexes of strength than that of the control, unimpregnated beeches. (*In Ukrainian.*) Mitsnist' bukovoï derevyny, prosochenoï na pni. ***P. H. Krotkevych.*** *Akademiia Nauk Ukrains'koi RSR, Dopovidi*, 1959, no. 1, p. 101-106.

8481* Experiments on the Origin of Oak-Bark Tannin. Discusses variation in the tannin content of stembark with age, disturbances in the normal distribution of tannin in stembark brought about by the ringing of the bark, the translocation of phenolic precursors of the tannin in the sieve tubes of the phloem. ***D. E. Hathway.*** *Biochemical Journal*, v. 71, no. 3, Mar. 1959, p. 533-537.

8482 The Water-Conducting Systems in Conifers and Their Importance to the Distribution of Trunk Injected Chemicals. The routes by which water is conducted upward in conifers have been studied by injecting Acid Fuchsin near the base of young to middle-aged trees belonging to 23 species from 12 genera and 4 families. A few days after the dye had been injected, the trees were felled and sectioned to see whether the dye solution had moved directly upward or deviated from the axis of the tree in the several growth rings where it had been incorporated. Five different patterns of translocation were detected in the sapwood of the conifers examined. These five types of water-conducting systems are described, and the way they effect distribution of the injected materials is presented. ***J. P. Vité and J. A. Rudinsky.*** *Boyce Thompson Institute, Contributions*, v. 20, no. 1, Jan.-Mar. 1959, p. 27-38.

8483* Studies in Forest Pathology. XX. Investigations of the Pathological Deterioration in Killed Balsam Fir. Assesses the significance and inter-relationships of five fungi consistently associated with the deterioration of balsam fir trees killed by the spruce budworm, and seeks to explain the succession pattern of the fungi in that process. ***J. T. Basham.*** *Canadian Journal of Botany*, v. 37, no. 2, Mar. 1959, p. 291-326 + 3 plates.

8484* Dyeing. I. The Chemistry of Dyeing. II. Continuous Molten Metal Dyeing—Development in the Standfast Processes. III. "Procion" Dyestuffs. Since it was first introduced several years ago, there has been a continuous development in the Standfast molten metal continuous dyeing method. There are now two different systems available, and the process has been extended to yarns and narrow fabrics. This article describes the present stage of development. The original conception and application of the molten metal vat dyeing process embodied the principle of floating a leuco dye solution on the surface of a molten metal bath, through which the prepared and pre-heated cloth was passed vertically downward. It thus absorbed the dye solution and was subsequently subjected to the squeeze of the hot, heavy metal; and this fluid pressure ensured a uniform dye content across the whole width of the cloth. The squeezing action of the molten metal on the cloth at entry permits a high liquor-to-cloth ratio of approximately 1·4 to 1: this facilitates the dyeing of dark shades and, as the cloth is fully immersed in the metal during the period of dyeing, it is protected from air oxidation—thus removing a source of trouble experienced in the application of vat dyes by other methods. *Fibres International*, v. 20, Apr. 1959, p. 113 + 11 pages.

8485* Dimensional Stabilization of Wood. V. Phthaloylation. Phthaloylation imparts to wood the highest degree of dimensional stability yet observed, but because of the partially temporary character of the stability it imparts, phthaloylated wood could only be used to advantage as a dimensionally stable product in cases where the wood is subjected to normal changes in atmospheric humidity but not to soaking. ***J. Risi and D. F. Arseneau.*** *Forest Products Journal*, v. 8, Sept. 1958, p. 252-255.

8486* A Comparison of Methods of Evaluating Exterior Natural Finishes. ***J. H. Burger.*** *Forest Products Journal,* v. 8, Oct. 1958, p. 282-287.

8487* The Fundamentals of Water Vapor Sorption by Wood. Experimental sorption data for 16 species, of both domestic and tropical origin, and acetylated white spruce were treated by means of a theoretical equation. ***H. A. Spalt.*** *Forest Products Journal,* v. 8, Oct. 1958, p. 288-295.

8488* Effect of Particle Geometry and Resin Content on Bending Strength of Oak Flake Board. Bending strength increased with increase in flake length up to 4 inches. Effect of resin content was secondary to flake geometry. Increased flake thickness decreased strength markedly, although this may be partially due to differences in flake surface quality. Strength increases with the length-to-thickness ratio up to 300. ***P. W. Post.*** *Forest Products Journal,* v. 8, Oct. 1958, p. 317-322.

8489 The Higher Terpenoids. The third book of a series of texts of natural products; the following subjects are covered: the diterpenoids, the triterpenoids, the biogenetic relationships of the terpenoids. ***P. de Mayo.*** v. III. 239 pp. 1959. Interscience Publishers, New York. (QD416 D39h)

8490 Benzene-Alcohol-Soluble Extractives of Sitka Spruce. ***P. J. Kohlbrenner and C. Schuerch.*** *Journal of Organic Chemistry,* v. 24, Feb. 1959, p. 166-172.

8491 Mono- and Sesquiterpenoids. The second book of a series of texts on the constitution of natural products; the following subjects are covered: the monoterpenoids, monocyclic, bycyclic monoterpenoids, the sesquiterpenoids. ***P. de Mayo.*** v. II. 320 pp. 1959. Interscience Publishers, New York. (QD416 D39m)

8492* Investigation of Porous Wood as Pulp Raw Material. III. Fibre Dimensions of Several NW European Wood Species. ***Henrik H. Bruun and Svein Slungaard.*** *Paperi ja Puu,* v. 41, no. 2, Feb. 1959, p. 31-34.

WELDING AND JOINING

8493 Adhesive Bonding of Reinforced Plastics. This book is devoted to a discussion of those topics which bear on the problems of the design and production of adhesive bonded assemblies containing parts reinforced with glass fibers or similar fibrous materials, alone or in combination with parts made of metals or other isotropic materials. ***Henry Alexander Perry.*** 275 pp. 1959. McGraw-Hill, New York. (TP986 P42a)

8494 Adhesive Bonding. Fairchild Production Processing and Tooling Techniques. Discusses redux-bonding used by Fairchild in manufacturing the F-27. ***Daniel E. Winter.*** *Aircraft Production,* v. 21, Apr. 1959, p. 150-159.

8495 Adhesive Bonding Builds Aircraft Structures. Bonding is less expensive than riveting, and it produces stronger, more rigid, and lighter structures. Fairchild Aircraft, Hagerstown, Md., is proving this by building 54% of the airframe for its new F-27 turboprop airliner with panels that include bonded joints. Production is centered around the largest integrated bonding facility in the country, and undoubtedly in the world. ***D. E. Winter.*** *American Machinist,* v. 103, Apr. 6, 1959, p. 134-137.

8496 Welding and Brazing of Molybdenum. In preparing this report, it was felt that only data obtained during the last 5 or 6 years are of value, because of the improvements in purity over that of commercial Mo produced prior to this time. During the past few years, there has been a noticeable improvement in the ductility of fusion welds in Mo, which can be directly related to improvements in the commercially produced metal. This report covers most of the published work on joining Mo to itself. The metallurgical considerations involved in joining Mo are discussed, as well as testing, cleaning, and joining procedures. ***N. E. Weare and R. E. Monroe.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 108, Mar. 1, 1959, 44 pp. (TN799.T5 B32.7t Vis.)

8497 Structural Applications of Stud Welding. Stud welding is increasingly finding applications in structural work. This paper describes uses of the process in the construction of large tanks and other vessels, gantry cranes, bridging, and buildings, where the particular characteristics of stud welding can lead to economies and speed up erection. ***R. W. Taylor and J. C. Chapman.*** *British Welding Journal,* v. 6, Mar. 1959, p. 97-104.

8498 The Present Position on the Economics of Welding. The effect of various factors on productivity, and the extension of inter-firm productivity comparisons are considered worthwhile topics for future research and development in the field of the economics of welding. ***A. G. Thompson.*** *British Welding Journal,* v. 6, Mar. 1959, p. 105-108.

8499 Economics of Multi-Spotwelding. Cost comparisons are made with the ordinary gun-welding techniques, and it is considered that where production demands are great enough the use of relatively expensive multi-spotwelding machines is justified by the savings in production time and labor costs. ***M. H. Lummus.*** *British Welding Journal,* v. 6, Mar. 1959, p. 109-115.

8500 Dynamics of Welding Production Management. The paper outlines the salient factors that should be considered in the establishment of an organization to produce efficiently welded structures at economical costs. ***D. M. Kerr.*** *British Welding Journal,* v. 6, Mar. 1959, p. 116-124.

8501 Recommended Practice for Radiographic Inspection of Fusion-Welded Joints. For Steel Plates Up to 2 In. (50 MM). *British Welding Journal,* v. 6, Mar. 1959, p. 126-128.

8502 Welding in CO_2 With Thin Electrode Wire. ***A. G. Potaperskii.*** *British Welding Journal,* v. 6, Mar. 1959, p. 129-131.

8503 Temperature Distribution Through the Weld Pool in the Automatic Welding of Aluminium. The temperatures in the weld pool of aluminum welded automatically were measured using chromel-alumel and Pt-Pt/Rh immersion thermocouples. The effects of welding rate, arc voltage, and parent metal temperature on the distribution of temperatures in the weld pool were studied. ***D. M. Rabkin.*** *British Welding Journal,* v. 6, Mar. 1959, p. 132-137.

8504 Effect of Columbium on the Structure of Welds in Austenitic 18-8 Steels. ***N. F. Lashko.*** *Henry Brutcher Translation No.* 4413, 8 pp. (From *Avtomaticheskaya Svarka,* v. 11, no. 6, 1958, p. 84-87.) Henry Brutcher, Altadena, Calif.

8505 Formation of a New Phase in 18-8 Steel Welds Containing Columbium. ***G. G. Mukhin and N. Yu. Pal'chuk.*** *Henry Brutcher Translation No.* 4462, 8 pp. (From *Avtomaticheskaya Svarka,* v. 11, no. 6, 1958, p. 88-91.) Henry Brutcher, Altadena, Calif.

8506 New Closure Out to Win Chemical Processing Jobs by Hook and Loop. With a just-completed design improvement aimed at increasing its strength, a new fastening device is now being launched on a campaign to win industrial jobs, such as simplifying the attachment of filter cloths. The novel closure device, Velcro, has already scored in the clothing field as a competitor of zippers. *Chemical Week,* v. 84, no. 15, Apr. 11, 1959, p. 104-106.

8507 The Fatigue Strength of Flame-Cut Steel Specimens Repaired by Welding. ***A. Matting, H. Wolf, and H. D. Steffens.*** *Engineers' Digest,* v. 20, Mar. 1959, p. 120-124. (Translated from *Schweissen und Schnieden,* v. 11, no. 1, Jan. 1959, p. 8-16.)

8508* Chemical Foam Extension of Urea-Formaldehyde Glues. The advantage of foamed resin is lower cost. In effect, air or inert gas serves as a filler, which escaped during bonding without harmful effect. "Chemical" foam is more stable than "mechanical" foam. Spread should be between 15 and 25 pounds per thousand square feet of single glue line. ***L. F. Bornstein.*** *Forest Products Journal,* v. 8, Oct. 1958, p. 51A-54A.

8509* A Survey of Adhesives for Edge and End Gluing. Nine adhesives and combinations of adhesives are discussed. Given for each are physical characteristics, pot life and storage

life, method of mixing, approximate cost, color, and method of curing. ***Max H. Estep.*** *Forest Products Journal*, v. 8, Oct. 1958, p. 55A-56A.

8510* Adhesives Cut Costs on High-Pressure Duct Jobs. The use of adhesive sealers on high-pressure ductwork can result in substantial savings over the all-welded method, according to the author. ***Al Casada.*** *Heating & Air Conditioning Contractor*, v. 50, no. 7, Apr. 1959, p. 60-61.

8511* Welding Distortion: What Causes It and How to Cure It. An expert tells how to control distortion and shrinkage in welded fabrications and how you can even make it work to advantage. ***Louis J. Larson.*** *Industry & Welding*, v. 32, Apr. 1959, p. 35 + 2 pages.

8512* 700 KVA Machine Fabricates 10-Tons of Grating in 8 Hours. Accurate automatic loading, precision notching and forming, and automatic resistance welding makes possible high volume production. *Industry & Welding*, v. 32, Apr. 1959, p. 37 + 2 pages.

8513* Ultrasonic Welding: Theory and Practice. Aluminum, platinum, moly and other metals can be welded ultrasonically without alloying of base metal microstructures. ***J. R. Wirt.*** *Industry & Welding*, v. 32, Apr. 1959, p. 38-39.

8514* Automatic Equipment Speeds Welding, Eliminates Rejects. When Ryan switched to automatic welding, rejects dropped from 84 per cent to less than one per cent; welding time was cut 90 per cent. *Industry & Welding*, v. 32, Apr. 1959, p. 40 + 1 page.

8515* Highway Guard Rails Are Designed for Welded Fabrication. Proper welded design and good fabricating and welding techniques combine to make a low-cost, high-quality product. *Industry & Welding*, v. 32, Apr. 1959, p. 46-47.

8516* Redesign for Welding Speeds Fabrication of 180-Ton Slab Pusher. Pattern storage and maintenance are no problem now that Morgan has switched to stronger and more versatile welding on slab pusher fabrication. *Industry & Welding*, v. 32, Apr. 1959, p. 52-53.

8517* Welding the Jupiter. Mig, Tig, and resistance methods are used in longitudinal, circumferential, and spot welding of aluminum-alloy components for the fuel-tank container sections of this intermediate-range ballistic missile. *Machinery (New York)*, v. 65, no. 8, Apr. 1959, p. 111-115.

8518* Pipe Joints Prepared in Minutes. The close fit obtained makes possible a good root-pass—the "secret" of a strong weld. *Machinery (New York)*, v. 65, no. 8, Apr. 1959, p. 139-140.

8519 Welded Aluminium Tube. Independent laboratory tests on the tubes have shown by microanalysis that the weld point is truly homogeneous, and the tubes may be formed, shaped, pierced, polished, and even anodized. *Metal Industry*, v. 94, Mar. 13, 1959, p. 211.

8520 The Effect of Surface Preparation on the Adhesion of Bearing Metal to Steel. Steel bearing shells may be cleaned by grit or shot-blasting or by acid pickling prior to hot-tinning and lining with whitemetal. While shot-blasting may provide adequate adhesion, preparation by pickling is to be preferred where maximum bond strength is required. ***C. J. Thwaites.*** *Metallurgia*, v. 59, Mar. 1959, p. 121-124.

8521 Welding and Heat Treating Rocket Cases. Rocket engine cases are fabricated from precise weldments of alloy steels which are heat treated to give high strength. Cases are quenched from austenitizing temperature into salt at 350 F to minimize distortion. ***C. N. Scott.*** *Metal Progress*, v. 75, no. 3, Mar. 1959, p. 99-102.

8522* Strong Welds at Brazing Temperatures. Primarily used for repairs but nevertheless applicable to production, is the low heat input welding technique. By the use of special alloys and fluxes, welds of exceptional strength are obtained without raising the parent metal to its melting point. *Metalworking Production*, v. 103, no. 14, Apr. 3, 1959, p. 583-586.

8523 New Method for Bonding Aluminum. A method of soldering aluminum which simplifies previous procedures has been developed by Intertectics, Inc., of Cleveland, Ohio. The procedure used involves heating the aluminium to 800 F, after which a solder wire is passed along the line where the two pieces are to be joined. The wire is a mixture of zinc, lithium, potassium, and sodium chloride covered with a zinc sheath. This mixture of salts and metal results in a flux which lifts the oxide coating from the aluminum and bonds the aluminum with an alloy of zinc. ***Nelson F. Murphy.*** *Products Finishing*, v. 23, no. 7, Apr. 1959, p. 76.

8524 Recent Advances in Gelatin and Glue Research. Sixty-six papers on collagen technology which constitute the proceedings of a conference sponsored by the British Gelatine and Glue Research Association held at the University of Cambridge, July 1-5, 1957. ***G. Stainsby, editor.*** 277 pp. 1958. Pergamon Press, New York. (TP965 B77r)

8525* Weldability of Different Types of Carbon Steel or Alloyed Steel. An investigation of weldability connected with the brittleness of steel and its use as a structural material tested in relation to temperature and size, and an introduction to the study of the area thermally affected by welding. (*In French.*) Sur la soudabilité de divers aciers au carbone ou alliés. ***P. Bastien, Ch. Dubois, H. Lejay, and C. Roques.*** *Soudage et Techniques Connexes*, v. 13, nos. 1-2, Jan.-Feb. 1959, p. 5-30.

8526* The Welding of Nickel and of the High Nickel Content Alloys in the Chemical Industry. Nickel for storing caustic alkali or phenol and having a maximum C content of 0.02%, and Ni-Cu, Ni-Cr-Fe, Ni-Mo, Ni-Mo-Cr, and Ni-Co-Mo-Fe alloys were considered together with a short survey of their applications. (*In French.*) Le soudage du nickel et des alliages à haute teneur en nickel dans l'industrie chimique. ***J. Hinde.*** *Soudage et Techniques Connexes*, v. 13, nos. 1-2, Jan.-Feb. 1959, p. 43-51.

8527 Butt Welding Proves Out For Thin Gages. The new technique of butt welding has brought the advantages of stronger and smoother weld seams and better post-weld formability to a wide variety of thin-gage aircraft and missile parts. Here is a report on the production setup needed for butt welding and on the various applications of this process. ***Gilbert C. Close.*** *Space/Aeronautics*, v. 31, no. 4, Apr. 1959, p. 81 + 3 pages.

8528 Safe Practices for Inert-Gas Metal-Arc Welding. *Tool Engineer*, v. 42, no. 4, Apr. 1959, p. 138.

8529 The Inert-Gas-Shielded Metal-Arc Welding of Titanium. The program consisted mainly of developing welding procedures for the single-pass full-penetration square butt welding of ¼-in.-thick titanium plates in the downhand position. ***E. A. Franco-Ferreira and P. Patriarca.*** *U. S. Atomic Energy Commission, ORNL-2612*, Mar. 18, 1959, 57 pp. (UF767 U3o Contin.)

8530 Internal-Stress Distribution of Single Spot Welds in Relation to Their Fatigue Life. Main objective of WRC investigation is to determine the reasons why an outstanding improvement in the fatigue resistance of spot welds can be brought about by a specific hydrodynamic treatment. ***G. Welter and A. Choquet.*** *Welding Journal*, v. 38, Apr. 1959, p. 145s-158s.

8531 Effect of Residual Stress on Brittle Fracture. Japanese authors report the results of their studies on the brittle fracture of welded structures at low stress level. ***Hiroshi Kihara and Koichi Masubuchi.*** *Welding Journal*, v. 38, Apr. 1959, p. 159s-168s.

8532 Cast-Pin Tear Test for Susceptibility to Hot Cracking. Susceptibility of alloys to hot cracking, such as might occur during freezing of a weld bead, is evaluated by means of a recently developed test. ***F. C. Hull.*** *Welding Journal*, v. 38, Apr. 1959, p. 176s-181s.

8533 Corrosion of Stainless-Steel Welds Formed With Carbon-Dioxide Shielding. Authors compare the effect on weld chemistry and corrosion resistance of stainless-steel weldments made under carbon-dioxide shielding with similar welds made

under argon plus one per cent oxygen. ***B. E. Hopkinson and D. W. McDowell.*** *Welding Journal*, v. 38, Apr. 1959, p. 188s-193s.

8534 Effects of Hydrogen Brazing on Properties of High-Temperature Alloys. Eight alloys used for fabricated jet-engine components are subjected to brazing thermal cycles and subsequently tested for tensile and stress-rupture properties. ***G. S. Hoppin, III and E. N. Bamberger.*** *Welding Journal*, v. 38, Apr. 1959, p. 194s-201s.

8535 Quartz-Lamp Radiant Brazing of Titanium-Alloy Honeycomb Sandwich Panels. Process is described and a discussion of its possible application to full-sized production panels is presented by the authors. ***John F. Rudy, Robert M. Necheles, and Harry Schwartzbart.*** *Welding Journal*, v. 38, Apr. 1959, p. 202s-208s.

8536 Welding of Equipment for the Dresden Nuclear Power Station. Materials, processes, and quality-control methods employed in the fabrication of the equipment in the nuclear portion of the plant are described. ***William R. Smith.*** *Welding Journal*, v. 38, Apr. 1959, p. 307-316.

8537 Hampton Road All-Welded Steel Arch Bridge. Use of welding permitted rapid and economical fabrication and erection of this bridge and produced a structure of especially pleasing aesthetic appearance. ***Wm. Llewellyn Powell, Douglas A. Nettleton, Milton E. Eliot, and Joe C. Bridgefarmer.*** *Welding Journal*, v. 38, Apr. 1959, p. 317-325.

8538 Progress Report on the Flux-Cored CO_2 Welding Process. This process has found many and diversified applications in industry since its introduction about two years ago. ***A. F. Chouinard and J. A. Howery.*** *Welding Journal*, v. 38, Apr. 1959, p. 334-341.

8539 Development of Welded-Steel Lathes. This paper discusses the basic objectives of a new lathe development and the reasons a welded-steel design is used. It also demonstrates the type of original engineering thinking and willingness to depart from convention that is essential to take full advantage of the freedom of design possible with welded steel. The use of models and the welding of the lathe structures are also discussed. ***Gordon M. Sommer.*** *Welding Journal*, v. 38, Apr. 1959, p. 342-346.

8540 The Welding of Inconel for Nuclear-Power Applications. Inconel-tubed steam generators can be welded to conform to the desired quality levels through the use of suitably controlled inert-gas processes and a titanium-manganese modified filler wire. ***W. A. Fragetta and G. R. Pease.*** *Welding Journal*, v. 38, Apr. 1959, p. 347-356.

8541 Eight Miles of Welding on Cantilevered Plate Girders for Service Hangar. ***Joseph Strauss.*** *Welding Journal*, v. 38, Apr. 1959, p. 357-358.

8542 All-Welded Aluminum Boat Gives High-Speed Performance. A uniquely designed, all-welded aluminum personnel boat whose high-speed performance could revolutionize water transportation has been unveiled by Higgins, Inc., New Orleans, La. The unusual hull form of the 52-ft craft makes possible riding qualities and maneuverability previously unobtainable in high-speed vessels in other than calm water. *Welding Journal*, v. 38, Apr. 1959, p. 359.

8543 Welded-Steel Flasks Prove Highly Successful. Arc-welded foundry flasks made from fabricated-steel components have been gaining favor with the foundry industry. ***R. P. Wolgast.*** *Welding Journal*, v. 38, Apr. 1959, p. 360-361.

8544 Welding of Plastics. Here is the only comprehensive treatment of all phases of this subject ranging from initial design procedures to final detailed fabrication methods. Various physical and chemical properties of individual plastics presently used for welded construction are completely covered with regard to their use in chemical and allied processing. All presently known techniques of welding are covered in detail and many step-by-step procedures with photographs are included. ***J. Alex Neumann and Frank J. Bockhoff.*** 279 pp. 1959. Reinhold Publishing Corp., New York. (TP986 N39w.)

See also: **7667** (resistance welding of vinyl coated steel sheet).

MISCELLANEOUS

8545 Putting a Solid Foundation Under the 'Ivory Tower'. Discusses some of the problems associated with the increasing dependence of university research on government sponsorship. ***Lawrence H. O'Neill.*** *Air Force*, v. 42, Apr. 1959, p. 98 + 4 pages.

8546* How Many of a Group of Random Numbers Will Be Usable in Selecting a Particular Sample? When a sample is selected from a finite population by employing random numbers, certain numbers may have to be discarded as not being usable. In the first place, some of the random numbers may not correspond to serial numbers in the population. In the second place, some random numbers may be duplicates of others. The number of usable random numbers remaining is a random variable with a probability distribution. Exact formulas for this distribution, and for the factorial moments of the difference between the number remaining and the population size, are derived and discussed. ***Howard L. Jones.*** *American Statistical Association, Journal*, v. 54, no. 285, Mar. 1959, p. 102-122.

8547* Compact Table of Twelve Probability Levels of the Symmetric Binomial Cumulative Distribution for Sample Sizes to 1,000. A compact table of critical values for tests of the symmetric binomial cumulative distribution is presented. It covers twelve probability levels (.001, .01, .02, .05, .10, .20, .30, .50, .70, .80, .90, and .95) for sample sizes to 1,000. ***William J. MacKinnon.*** *American Statistical Association, Journal*, v. 54, no. 285, Mar. 1959, p. 164-172.

8548* A Production Model and Continuous Sampling Plan. A production model is considered where the quality of output decreases until corrective action is taken and then the cycle is repeated. For this model, the sampling plan of examining each Fth item and taking corrective action whenever a defective is found, is evaluated. ***I. Richard Savage.*** *American Statistical Association, Journal*, v. 54, no. 285, Mar. 1959, p. 231-247.

8549* Minimum Risk Specification Limits. Mathematical formulas are derived and tables given which facilitate the construction of minimum risk specification limits. A variety of assumptions about relations among costs and relations between inherent process variation and measurement error are covered. ***F. H. Tingey and J. A. Merrill.*** *American Statistical Association, Journal*, v. 54, no. 285, Mar. 1959, p. 260-274.

8550* The Russell Grimwade Lecture. Some Thoughts on the Organization of Large Technological Concerns. Delivered before the Royal Australian Chemical Institute, Melbourne. ***Alexander Fleck.*** *Australasian Engineer*, 1959, Feb. 7, p. 54-59.

8551 Picking Europe's Research Brains. Lists European organizations now performing contract research. However, contracts are often hard to obtain. Battelle's policy of favoring contracts with foreign companies in its Geneva and Frankfurt laboratories is mentioned. *Business Week*, no. 1547, Apr. 25, 1959, p. 78 + 5 pages.

8552 Chemist's Profile Redrawn. Study of chemists' work week activities performed by Case Institute of Technology. Nearly half of time is spent communicating. *Chemical and Engineering News*, v. 37, no. 14, Apr. 6, 1959, p. 29-30.

8553 Cooperative Industrial Research Is Fine if Results Are Freely Available to All. The Department of Justice is not opposed to cooperative research projects among industry members as long as results are made freely available to those industry members without restrictions on their rights to use technological information developed. Such cooperative efforts can minimize research costs of industry members and maximize

benefits they can obtain from scientific research facilities of other cooperating members. ***Victor R. Hansen.*** *Chemical Processing*, v. 22, Apr. 1959, p. 29 + 2 pages.

8554 The Endless Frontier of Research. At war's end it had become obvious that it was not good enough to rely so largely upon the casual consultant system whereby local university professors acted as advisers to industry and suggesters of new processes. No longer was it sound industrial practice to regard such professors as expert on all aspects of their field, including application of their theoretical and laboratory studies to industrial production. The gap to be bridged between laboratory experiments and industrial-scale production had become too great. What was needed were units able to carry out the steady, methodical investigation of natural phenomena. In the past twenty years, long-range research in industrial laboratories has paid tremendous dividends. *Chemistry & Industry*, 1959, no. 11, Mar. 14, p. 342.

8555 Building Research in Canada. As a branch of applied research, organized building research is a relatively modern development, all but one of the many national building research establishments having been founded within the last 15 years. Canada's own building research organization was started in 1947 as a unit of the National Research Council of Canada. ***Robert F. Legget.*** *Chemistry & Industry*, 1959, no. 11, Mar. 14, p. 342-348.

8556* What Price Socialization of Engineering? In recent years, the trend toward socialization of the civil engineering profession in the United States has been progressing at an alarming rate. If this trend continues, all well-meaning efforts of the various engineering societies to gain professional recognition will have been for a lost cause. The author points out the dangers that the inroads of government into this phase of private enterprise will create, and what should be done to avoid them. ***Donald A. Walsh.*** *Civil Engineering*, v. 29, Apr. 1959, p. 56-58.

8557* Opposition to New Ideas—Controversy. Criticizes the article "Opposition to New Ideas" by Neil Macdonald in February, 1959, issue of *Computers and Automaton*. Appended is an answer by Macdonald. ***Patrick J. McGovern.*** *Computers and Automation*, v. 8, Apr. 1959, p. 25-28.

8558 Patent Thoughts and Trends. An outline of patenting from the point of view of the drug industry. ***Thomas Cifelli, Jr.*** *Drug and Cosmetic Industry*, v. 84, no. 4, Apr. 1959, p. 467 + 4 pages.

8559 Today's Electronic Engineer. Thousands of questionnaires went out to engineers in all parts of the country. Questions such as: What is your income today? What was your income 5 years ago? What is the worth of your liquid assets? How many firms have you worked for? etc., were asked. *Electronic Industries*, v. 18, Mar. 1959, p. 249 + 12 pages.

8560 The Neglected Capital. Our neglected capital is brainpower. To combat the economic competition from Europe, from Russia, and for other economic units of the future, we must rally not only our resources of raw materials, energy, and manpower, but also our resources of brainpower. This calls for a strengthening of our educational system. ***Sydney Steele.*** *Franklin Institute, Journal*, v. 267, no. 4, Apr. 1959, p. 295-302.

8561 Games and Decisions: Introduction and Critical Survey. This book surveys the central ideas and results of game theory and related decision making models without making use of excessive mathematical detail. It integrates recent developments noted previously only in the scattered literature. It describes the mathematical attempts to deal with such problems as value (or utility), subjective probability, conflict of interest (game theory), decision making under uncertainty, and social resolutions of value conflicts. ***R. Duncan Luce and Howard Raiffa.*** 509 pp. 1957. John Wiley & Sons, New York. (QA269 L96g)

8562 The Optimum Climate for Industrial Research. The author discusses the optimum climate needed for professional research work, and suggests basic changes in management attitudes. ***Charles D. Orth, III.*** *Harvard Business Review*, v. 37, no. 2, Mar.-Apr. 1959, p. 55-64.

8563* Eye Protection in the Chemical Industry. A report on six years' experience with an eye protection program which cut disabling eye injuries by eighty-eight per cent. ***Roy E. Joyner.*** *Industrial Medicine and Surgery*, v. 28, Apr. 1959, p. 174-177.

8564 New Material Handling Facilities. Great Lakes limestone and coal handling equipment for unloading vessels and stocking is described. ***A. Donald Shattuck.*** *Iron and Steel Engineer*, v. 36, Apr. 1959, p. 79-82.

8565* Composition of Solutions of Linear Partial Differential Equations in Two Independent Variables. The purpose of this paper is to establish a formula which associates with any two solutions u and v of a linear homogeneous partial differential equation with constant coefficients in two independent variables x, y a new solution w which depends bilinearly on u and v. ***Hans Lewy.*** *Journal of Mathematics and Mechanics*, v. 8, no. 2, Mar. 1959, p. 185-192.

8566* The Solution and Huygens' Principle for a Singular Cauchy Problem. The subject of this paper is a study of a singular Cauchy problem for a hyperbolic partial differential equation in $m + 1$ variables. The classical problem in this domain is that for the Euler-Poisson-Darboux (EPD) equation, which in its full generality has been investigated extensively since the appearance of Weinstein's paper in 1952. Our equation, restricted to two variables, goes back also to Euler and Darboux. ***David W. Fox.*** *Journal of Mathematics and Mechanics*, v. 8, no. 2, Mar. 1959, p. 197-219.

8567* Solutions of a Riccati Matrix Differential Equation as Functions of Initial Values. It is the purpose of the present paper to extend the results of Redheffer to matrix differential equations of Riccati type. The method of proof used here is based on the properties of solutions of a related system of linear diffential equations. ***William T. Reid.*** *Journal of Mathematics and Mechanics*, v. 8, no. 2, Mar. 1959, p. 221-230.

8568* An Elementary Analytic Theory of the Degree of Mapping in n-Dimensional Space. The main properties of the Brouwer degree are established by a method which is closely related to the work of De Rham, but seems to be of a more elementary character. In view of the applications to existent problems of analysis, the article is restricted to the cases where the given mapping $y = y(x)$ is defined in the closure of a bounded open set of the n-dimensional space. ***Erhard Heinz.*** *Journal of Mathematics and Mechanics*, v. 8, no. 2, Mar. 1959, p. 231-247.

8569* The Holonomy Group. I. The Curvature Tensor. This paper is the introductory part of a systematic study of over-determined systems of partial differential equations and their solutions obtained by algebraic methods. It deals with the mapping of connections. This is the first of four articles in this series. ***Václav Hlavatý.*** *Journal of Mathematics and Mechanics*, v. 8, no. 2, Mar. 1959, p. 285-307.

8570* Psychological Aspects of Confinement in Fallout Shelters. The shock of a thermonuclear attack would create numerous psychological problems; confinement in a shelter would intensify these and create new ones. Unchecked, these problems could result in "psychological casualties". Measures can be taken prior to any attack, however, which would help to alleviate these problems. ***J. Donaldson, K. Magnuson, L. McHugh, R. Niner, F. Watt, B. Williams, and A. Zink.*** *Journal of Psychology*, v. 47, Apr. 1959, p. 163-170.

8571 Stability and Error Bounds in the Numerical Integration of Ordinary Differential Equations. ***Germund Dahlquist.*** *Kungliga Tekniska Högskolans Handlingar*, no. 130, 1959, 85 pp. (T4 K96t Vis.)

8572* Mathematics and Biological Research. Some degree of specialization in particular biological fields is becoming essential if biometricians are to make their fullest contributions into research. In complement, an increasing mastery of the more elementary quantitative concepts may reasonably be sought among biologists. To assist in the latter respect, monographs on elementary statistical methodology with emphasis on the interpretation of examples, in particular biological disciplines, seem now desirable. ***C. P. Cox.*** *Laboratory Practice*, v. 8, Apr. 1959, p. 123 + 7 pages.

8573* Bulk Handling Titanium Sponge. As titanium sponge is both a vulnerable and expensive raw material, the use of the hermetically sealed bins has enabled the American titanium sponge manufacturers to maintain the quality of their product and hence the quality of the components in which titanium takes its place. ***A. E. Williams.*** *Mining Magazine*, v. 100, no. 3, Mar. 1959, p. 137-140.

8574* Finite Groups With Fixed-Point-Free Automorphisms of Prime Order. *John Thompson.* *National Academy of Sciences, Proceedings*, v. 45, Apr. 1959, p. 578-581.

8575 Scientific and Technological Research in Britain. Summarizes the findings published in the Tenth Annual Report of the Advisory Council on Scientific Policy for the years 1955 and 1956. *Nature*, v. 183, Mar. 28, 1959, p. 847-850.

8576 Ohio Turnpike Report: An Engineering Report of the Planning and Construction of the Ohio Turnpike Project No. 1. Describes our part of an 812-mile turnpike system which will carry automotive traffic across four states from New York to Chicago without a single traffic light or a single intersecting railroad or highway, or a single city traffic jam to impede the swift passage of passengers and cargo. ***Theodore J. Kauer.*** 150 pp. 1956. The Ohio State University, Columbus, Ohio. (TE24.03 K160)

8577* How Much Money Should Industry Spend on Research? "How much should a concern spend on research?" is like asking, "How long is a piece of string?"—in relation to what? This is a good general discussion from the English point of view. ***Ritchie Calder.*** *Optima*, v. 8, no. 3, Sept. 1958, p. 113-119.

8578* Blueprinting the Next Ten Years of Industrial Psychology (A Symposium). Topics discussed are as follows: "Needs and Developments in the Field of Personnel Requirements"; "Needs and Developments in Equipment and Technology"; "Morale, Motivation, and Related Areas"; "Top Management, Organization, and Related Areas"; and "Some Additional Prospects". ***C. H. Lawshe, Jack W. Dunlap, Robert L. Kahn, Carroll L. Shartle, and Raymond A. Katzell.*** *Personnel Psychology*, v. 12, no. 1, Spring 1959, p. 29-48.

8579 Proceedings of the Conference on Differential Equations. Conference was held at the University of Maryland, March 17, 18, 19, 1955, sponsored jointly by The Institute for Fluid Dynamics and Applied Mathematics, University of Maryland, and the Air Force Office of Scientific Research, Air Research and Development Command. The list of topics covered clearly illustrates the wide and diverse uses of differential equations both in mathematics and in the physical and engineering sciences. Papers presented covered historical developments as well as the most recent advances in various fields. ***J. B. Diaz and L. E. Payne, editors.*** 294 pp. 1956. University of Maryland Book Store, College Park, Md.

8580 To Make a Technical Decision. Essentials of decision-making are a consistent idea of your own objectives, the objectives of the organization; some glimmering of your own biases and your own adequacies, or inadequacies, of communication, and of your own awareness of the nontechnical environment. ***Merritt A. Williamson.*** *Product Engineering*, v. 30, no. 14, April 6, 1959, p. 35-36.

8581 Professional Creativity. Designed to be equally valuable for those of all interests, this book shows distinctly what creativeness is and how to contribute creatively through the effective interplay of aptitudes, resources, and planning. It is written to be of benefit both to the casual reader seeking stimulation through example and technique as well as to those who wish to study in depth the path to creative accomplishment. ***Eugene K. Von Fange.*** 260 pp. 1959. Prentice-Hall, Inc., Englewood Cliffs, N. J. (BF408 V89p)

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8593 Operational Calculus and Generalized Functions. In a preliminary discussion, the notion of an operational calculus is examined from an axiomatic point of view, and a general definition is formulated; systems of generalized functions are also considered axiomatically, and are shown to be necessary for the extension, under mild conditions, of differential operators on functions of a real variable. ***J. D. Weston.*** *Royal Society, Proceedings*, v. 250, ser. A, Apr. 7, 1959, p. 460-471.